Electrical World

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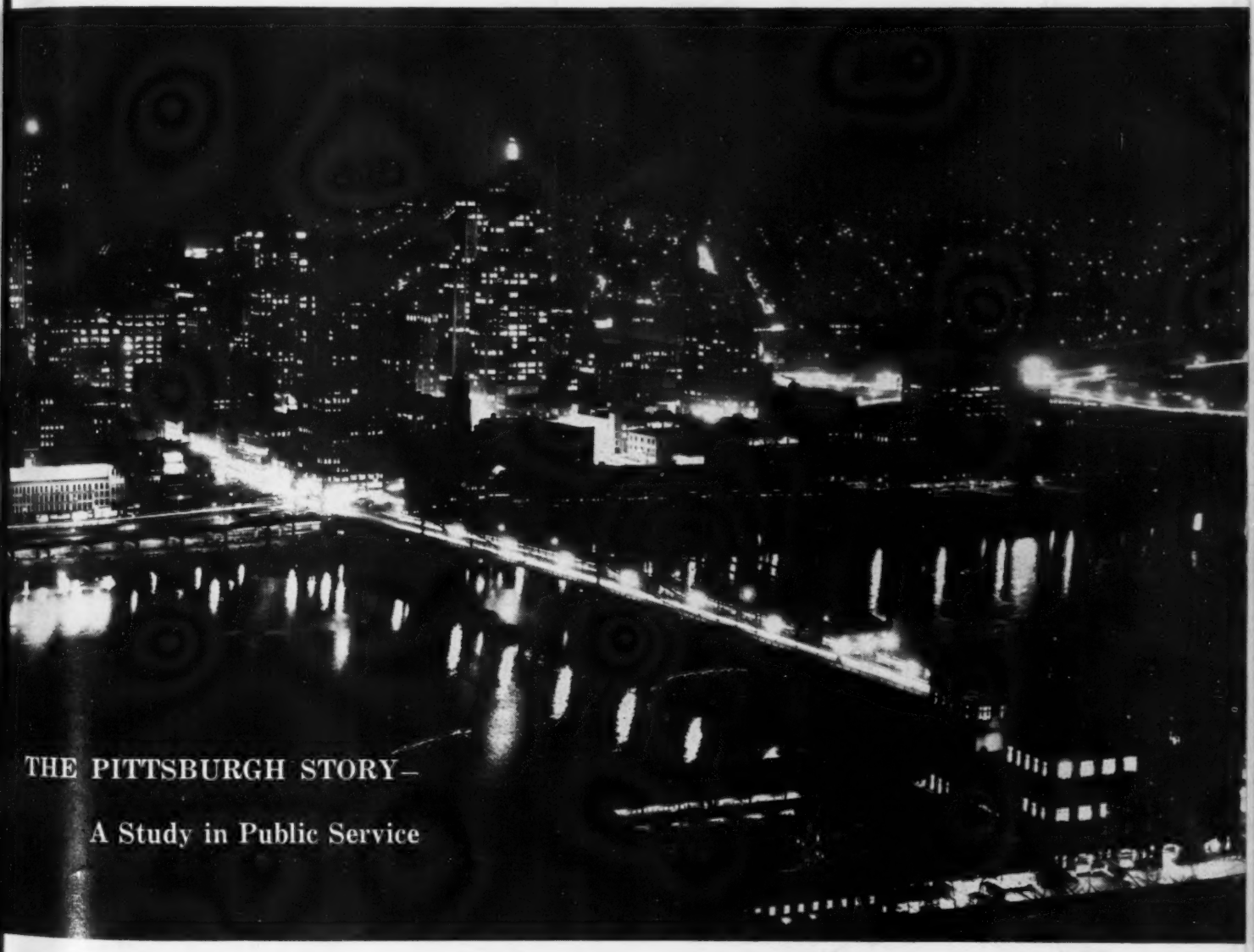

THE PITTSBURGH STORY—

A Study in Public Service

DECEMBER 7, 1946

Features

Prototype for 1,350-Deg. Gas Turbines

Electronic Controls for Fan and Stoker Drives—II

Line Shorting Contactor Improves Service

10,000,000,000 OHMS

for leakage resistance measurements at low potentials

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Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 72 YEARS

December 7, 1946 **Contents** Vol. 126, No. 23

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Looking northward across the Monongahela River, lights of strike-bound Pittsburgh shine through the fall darkness. See page 101.

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Electrical World

DECEMBER 7, 1946

Escape from Coal

THERE IS NO denying that coal is one of the most important of the commodities on whose continuing production the nation's economy and the welfare of its people depend. The people have been given a second chance to feel and to see how seriously their daily living and tasks can be disrupted by abrupt curtailment of the supply of solid fuel.

A big fraction of the impact falls in the field of electrical energy supply and the utilities have to act like soldiers again and be the patient medium through which the inevitable curtailments are administered. And their reward is loss of revenue and incurring of out-of-pocket expense. But all this is tolerable if the episode should, perchance, lead to a clearing of the muddied waters of labor relations. Whether that will be a fortunate consequence it is much too early to guess, let alone predict.

But it is safe to make one prediction; it is that the power industry will make a great mistake if it does not take advantage of the present provocation to push every kind of development that will emancipate the American people from subjugation to raw coal. John L. Lewis must be aware of the potential threats to his snug empire in the form of technological developments that afford an escape from coal as it is used today. These are over and above the mere mechanization of the mines and the efforts to ameliorate the conditions under which his supporters work.

Railroads and steamships have gone to oil, the railroads at a greatly accelerated rate in recent years. Also the railroads are giving consideration to extension of electrification. Many electric utilities are using oil and natural gas as power plant fuel. Meanwhile they and the equipment manufacturers have strained to improve the efficiency of converting coal into kilowatt-hours. These moves have had their effect in reducing the dependence on raw coal. The gas turbine, the mercury turbine and higher superheats work in the same direction.

But there are several more channels by which the power industry and those it serves can put the coal industry into a truly competitive position. Some of these are still in the unfinished stage but that is all the more reason for putting force and drive behind the programs to perfect them. Foremost in glamor if not in imminence is atomic energy. More pressure should be applied at once to free the derivation of atomic energy for industrial use from the stymies imposed by international entanglements.

Alabama Power Co. and the Bureau of Mines have set out on a program of gasifying the coal in the vein, making its removal from the mine unnecessary. Hydrogenation of coal offers somewhat comparable opportunities, at least to the extent of promising transportability by pipeline. Oil from shale is in the offing and, incidentally, entails a fairly good load to the power companies. With us always—as long as they remain undeveloped—are water power, solar power and tidal power. Even crossing the latter off the slate, there are thus several avenues of escape from the tyranny of coal. There is no better time than now to mean business as we go about the development of these loopholes of escape.

★ ★ NEWS OF THE

More Restrictions on Utilities Expected as Coal Dwindles

Supplies for Utilities Exempt from Freight Embargo—OEC Urges Maximum Conservation of Electricity—Utilities May Have to Cut Coal Consumption Two-Thirds if Strike Lasts

ADDITIONAL RESTRICTIONS on public utilities, as well as on all other coal-burning industries, loomed this week as federal agencies dug in for a protracted shutdown of the soft coal mines.

New hitches in the belt of the national economy were taken by the Office of Defense Transportation and others were being planned by coal conservation authorities in the Interior Department and other agencies. Civilian Production Administration's Office of Emergency Controls prepared to extend its curtailment of electric power service into new areas and further to reduce service in the states where Order U-14 already is in effect.

Also, OEC urged utilities to carry on a continuous consumer relations program aimed at impressing upon all electric power users the need for maximum conservation. Some companies, it was pointed out, have been doing this by newspaper advertisement and personal contacts, but the feeling at OEC at mid-week was that more had to be done.

ODT's embargo on rail freight and express shipments, effective December 6, exempts certain commodities and supplies necessary to the maintenance of public health and safety. The exemptions specifically include "supplies for public utility power plants," and ODT said that the order would permit rail shipment of repair or replacement parts and supplies for electric power plants. However, increased reductions in railroad schedules would necessitate the moving of as much material as possible by other transportation means.

Interior's fuel experts were devising means of stretching out the nation's limited coal stocks until mid-February or March. Economists of the Solid Fuels Administration, Bureau of Mines, and Coal Mines Administration estimated that electric utilities would have to reduce their consumption of coal from the approximately 6,900,000 tons used during a normal winter month to 2,300,000 tons. Reductions for other major industry would be even more drastic, these sources said.

These same agencies announced that, at the present time and rate of use, the country has about a 30-day subnormal supply of coal. A total over-all reduction in coal consumption from 53,600,000 tons per month to 23,600,000 tons per month will be necessary to keep public utilities and other vital public health and welfare services in operation on an emergency basis if the mines are closed for three months, they said.

OEC meanwhile considered the extension to the Southeast of the electric power curtailment, now in effect in 21 states and the District of Columbia. OEC Director Edward Falck conferred on December 2 with representatives of public and private utility systems in that area. As a result, Mr. Falck announced that the Southeast temporarily would remain exempt from provisions of U-14 but that another conference would be held with utility officials of that area in the near future.

Another result of this session was an agreement that Southeastern utilities would further increase their export of energy through system interconnections to assist areas where coal stocks were low. It is expected that large amounts of additional power can be supplied from gas-burning generating plants in Louisiana and from steam plants of the Tennessee Valley Authority—thus in effect transferring coal from the relatively large stockpile in the Southeast.

Administrator Falck warned the utility group that it might be called upon to supply railroads and other vital industries with coal from stocks that otherwise might be sufficient for several months of normal power generating operations. Coal stocks in the Carolinas, from which considerable amounts of energy are being supplied to hard-pressed Virginia systems, already are below normal, he warned.

At the request of the city manager of Hamilton, Ohio, OEC put into effect the service restrictions of U-14 Sched-

Wickard Describes Effects of Coal Strike on Co-ops

Claude Wickard, administrator of the Rural Electrification Administration, last week issued this statement on the effect of the coal strike on cooperatives:

"Many REA-financed systems have for some time been unable to obtain adequate power at wholesale to meet the needs of their consumers for full operation of electrical equipment essential to efficient farm production. Since approximately 50 percent of the power purchased by REA borrowers for distribution in rural areas is produced in steam plants, a prolonged strike probably would lead to further restrictions on the wholesale power purchases of many of the systems. This in turn would cause hardships on farms that have become increasingly dependent on electrical equipment in recent years.

"Of even greater concern to REA and its borrowers is the possible effect of the strike on steel production. Several hundred-thousand farm families are impatiently awaiting completion of rural lines for which REA loans have been allocated. Although new consumers are being connected at a greater rate than ever before in REA's history, our borrowers are unable to build lines fast enough to satisfy people who have been waiting for service since before the war. These people are likely to become even more impatient if diminishing supplies of transformers, meters and other materials should cause further delays in line construction."

ules 2 and 3 in that municipality. This was the first area in which the restrictions were imposed, although OEC officials said that Schedule 2 probably would be put into effect at several other points to relieve hard-pressed municipal systems. OEC originally had planned to impose the progressively increasing restrictions of Schedules 2 and 3 on an area basis, but the rapidly dwindling coal supplies of many small systems apparently would necessitate application of further curtailments wherever other measures failed to insure continued service.

OEC also denied several appeals for exemptions from U-14 submitted by companies having considerable stocks of either bituminous or anthracite on hand. The denials were based on OEC findings that the companies either supplied energy through interconnections to other systems which relied largely upon bituminous fuel, or that the appellants themselves could effect substantial savings of bituminous by complying with U-14.

Utilities reporting to OEC on the effects of the first several days of service curtailments generally noted that fuel savings had been somewhat less than they had expected. This was attributed largely to failure of commercial electric power users to comply fully with U-14 provisions in regard to interior lighting reductions. Outdoor illumination was curtailed as ordered, it was reported. No disconnections had been made as a result of repeated violations of the curtailment order at the time this was written.

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Jersey Utility Expansion Plan Totals $4,400,000

Jersey Central Power & Light Co., has announced that its plant expansion program, which was interrupted by the war, will be carried out immediately at a cost of $4,400,000.

The company's Raritan River plant at Sayreville will be expanded from 60,000-kw. capacity to 103,000-kw. by the summer of 1949. Building alterations were completed in 1942. Two 30,000-kw. units at this plant will be raised to 37,500 kw. each, and a 25,000-kw. hydrogen-cooled unit will be added.

METER STUDENTS—Children and wives of employees of the Indianapolis Power & Light Co. get an explanation of the workings of an electric meter from Verne O'Dell during a recent "get-acquainted" tour of the meter shop at the Morris Street operating center, where all electrical and construction departments are centralized. About 600 persons made the tour, the first since before the war

SFA Asks Utilities to Seek Coal from Regional Offices

Public utilities and other vital industries requiring soft coal were urged this week by the Solid Fuels Administration to file applications for additional fuel with one of SFA's 40 regional offices—not with SFA or any other agency in Washington, D. C.

Eligible industries, including all electric utilities which have abided by fuel conservation regulations, should apply in writing to the nearest SFA regional office for coal, SFA officials said. They may do so whenever their stocks on hand are sufficient for 10 days' operations or less.

SFA regional offices are located in the following cities:

Albany, N. Y.; Allentown, Pa.; Altoona, Pa.; Ashland, Ky.; Atlanta; Baltimore; Billings, Mont.; Birmingham, Ala.; Bluefield, W. Va.; Boston; Buffalo; Camden, N. J.; Casper, Wyo.; Charlotte, N. C.; Chicago; Cincinnati; Cleveland; Concord, N. H.; Denver; Des Moines, Iowa; Detroit; Fairmont, W. Va.; Harrisburg, Pa.; Indianapolis; Kansas City, Mo.; Knoxville, Tenn.; Madisonville, Ky.; Minneapolis; Newark, N. J.; New Haven, Conn.; New York; Philadelphia; Pittsburgh; Portland, Me.; Providence, R. I.; Richmond, Va.; Salt Lake City, Utah; Seattle, Wash.; St. Louis; and Syracuse, N. Y.

•

Utility and Co-op Officials in Minnesota Collaborate

Coordination of farm line extensions in the area, exchange of ideas and discussion of plans were the purposes of a recent meeting with REA co-op officials sponsored by Minnesota Power & Light Co. at Brainerd, Minn. General tone of the comments depreciated the speeches describing friction between the privately financed utilities and the REA co-ops in some other sections of the country.

Goals described by speakers from each group are the complete electrification of farms in the area and the general economic improvement of northeastern Minnesota. Working arrangements were advanced with the study of maps prepared to show all of the lines being planned. Material shortages were also discussed in relation to the delays in serving customers.

Arkansas Commission Has Jurisdiction before Courts

The Arkansas Public Service Commission instead of the courts should be the first to consider the United States government's contention that the Arkansas Power & Light Co. violated a contract governing resale of power from Norfork Dam, Federal Judge T. C. Trimble has decided.

The government had filed suit for $155,000 against A. P. & L. alleging the utility failed to make power purchased from government-owned Norfork dam in north Arkansas available to rural electric cooperatives at low rates as it had pledged to do in a contract with the Southwest Power Administration.

Judge Trimble, in a letter to the Public Service Commission, United States District Attorney James T. Gooch, and attorneys for A. P. & L., said the commission had regulatory jurisdiction over rates and contracts of all public utilities in the state and that the government's suit was "prematurely brought." He said he would order the case submitted to the commission.

•

Preston S. Arkwright Dies

Preston S. Arkwright, chairman of the board of the Georgia Power Co., Atlanta, died of pneumonia in that city on December 2 at the age of 75. Mr. Arkwright was president of the Georgia Power Co. and its predecessor companies for 43 years before his appointment to the board chairmanship last year.

New High Record Reached for Utility Peak Loads

The aggregate of major electric utility system peak loads for October, 1946, indicated a new record maximum of 40,457,000 kw., according to figures released by the Federal Power Commission.

October peak loads, totaling 12.9 percent higher than October of last year, exceeded by more than 1,000,000 kw. the previous maximum of 39,360,254 kw. set in September, 1946. The October peak load total in setting a new record high repeated the performance of the two previous months.

Corresponding energy requirements for October amounted to 19,895,621,000 kw.-hr., an increase of 14.1 percent over October of last year.

Schedules 2 and 3 of CPA Order U-14, Limiting Electricity Use

Schedule 2

When coal supplies drop to 15 days plus the transit time to get coal to the plant this schedule becomes effective. In addition to complying with the restrictions of Schedule 1, no consumer shall use electricity for any of the following purposes:

1. Outdoor flood lighting or other general outdoor illumination for amusement or sports.

2. Any other form of general outdoor or indoor illumination in or about any commercial, industrial, or other non-residential establishment in excess of 50 percent of the illumination normally used.

3. In excess of 50 percent of the passenger elevator or escalator services in any building having more than one passenger elevator or escalator.

4. In excess of 50 percent of the white way street lighting in effect during the base billing month, if this amount is less than the amount permitted under Schedule 1.

5. Commercial or industrial operations or processes which will consume in any consecutive seven-day period more than 15 percent of the amount of electricity consumed in each commercial, industrial, or other non-residential establishment during the base billing month.

Exceptions. The foregoing restrictions do not apply to:

1. The following essential community services: hospitals, refrigeration for food preservation plants, and newspapers.

2. Transportation services:

A. Urban, suburban or interurban common or contract carriers of passengers or freight including terminals.

B. Railways, terminals and related facilities.

C. Shipping on inland waterways, including locks and terminals and not including dredging.

D. Airports and airfields.

E. Oil pipe lines and pumping stations.

F. Maintenance and repair yards or shops used exclusively for the maintenance or repair of the above transportation services.

3. Communications services including:

A. Post offices.

B. Telephone and telegraph systems.

C. Radio communications.

D. Traffic control and signal systems.

4. Water supply and sanitation systems including waterworks, pumping stations and sewage disposal plants and equipment.

5. Manufactured, byproduct, natural and mixed gas systems, including manufacturing plants, pipe lines, pumping stations and facilities for the maintenance and repair thereof.

6. Plants exclusively engaged in the production, mining or refining of fuels.

7. Plants engaged in the production and processing of food for human and animal nutrition.

Schedule 3

When coal supplies drop to 10 days' plus the transit time to get coal to the plant this schedule becomes effective. In addition to complying with the restrictions of Schedules 1 and 2, no consumer shall use electricity for any of the following purposes:

1. Any form of general outdoor or indoor illumination in or about any commercial, industrial, or other non-residential establishment in excess of 30 percent of the illumination normally used.

2. In excess of 30 percent of the passenger elevator or escalator services in any building having more than one passenger elevator or escalator.

3. Commercial or industrial operations or processes which will consume in any consecutive seven-day period more than 7 percent of the amount of electricity consumed in each commercial, industrial, or other non-residential establishment during the base billing month.

4. Operation of electric street and interurban railways, including trolley buses, in excess of 50 percent of normal schedules.

Exceptions. The foregoing restrictions do not apply to:

1. The following essential community services: hospitals, refrigeration for food preservation plants, and newspapers.

2. Transportation services:

A. Railways, terminals and related facilities other than electric street and interurban railway and trolley buses.

B. Shipping on inland waterways, including locks and terminals and not including dredging.

C. Airports and airfields.

D. Oil pipelines and pumping stations.

E. Maintenance and repair yards or shops used exclusively for the maintenance or repair of the above transportation services.

3. Communications services including:

A. Post offices.

B. Telephone and telegraph systems.

C. Radio communications.

D. Traffic control and signal systems.

4. Water supply and sanitation systems including waterworks, pumping stations and sewage disposal plants and equipment.

5. Manufactured, byproduct, natural and mixed gas systems, including manufacturing plants, pipe lines, pumping stations and facilities for the maintenance and repair thereof.

6. Plants exclusively engaged in the production, mining or refining of fuels.

7. Plants engaged in the production and processing of food for human and animal nutrition.

Management Problems Get Attention at A.S.M.E. Meeting

Labor Leaders and Management Representatives Conduct Panel on Basic National Labor Policy—Agree That Labor Department Needs Reorganization and Collective Bargaining Must Be Kept

THAT THE PROBLEMS of management are the problems of the engineer was indicated this week as the management division of the American Society of Mechanical Engineers conducted four successful sessions as a part of the society's 67th annual meeting in New York.

A manufacturer, a publisher of a technical journal, and two labor leaders composed the panel which at the first session struggled over the topic, "A Basic National Labor Policy." Representing labor were Clinton Golden, adviser and consultant, United Steel Workers of America, C.I.O., and Frank Fenton, director of organization, A.F.L. Manufacturing representatives were Herman W. Steinkraus, president of the Bridgeport (Conn.) Brass Co., and Lee H. Hill, publisher of ELECTRICAL WORLD.

The panel was in agreement that collective bargaining must be preserved and that the Department of Labor needs reorganization but otherwise differed sharply.

Presenting the legislative side for management, Mr. Hill called for modification of the Wagner Act to protect the employer. He advocated legislation to protect the winning union from strikes by the losing union in a bargaining election. He advocated collective bargaining only for wages, hours, and working conditions and the outlawing of all strikes in which the employer is not involved such as jurisdictional, political, and sympathy strikes, and secondary boycotts.

Industry-Wide Bargaining Opposed

He also opposed industry-wide bargaining, which labor proponents favored.

Mr. Golden took the position that too much emphasis is placed on strikes, because many manufacturers have had satisfactory agreements with unions for many years. Since unions are here to stay, there must be a permanent national labor policy to remove fear from the minds of union men that their gains will be taken from them.

Taking the position that labor relations are actually human relations, Mr. Steinkraus called for the reorganization of the Department of Labor which, he said, was originally established to protect labor from organized management. Now he believes that its purpose should be to promote better relations between labor and management. He emphasized that if collective bargaining is to be done on the human relationship basis, it must be done at the local level.

Mr. Fenton called for adequate appropriations for the Department of Labor so that it can be reorganized and revitalized. He took the stand that management and labor can best solve their own problems; and that they had better, or else the government will step in with remedial legislation which will not solve the problems. He supported the closed shop because he feels that the unions have the right to determine the qualifications of their own members and that the open shop is the closed shop for the union man. Collective bargaining, he added, must be conducted in good faith by both parties.

Speaking at a management luncheon, Paul G. Hoffman, president of the Studebaker Corp., South Bend, Ind., outlined the worries besetting management today. He listed these as labor-management relations, punitive legislation, and inflation.

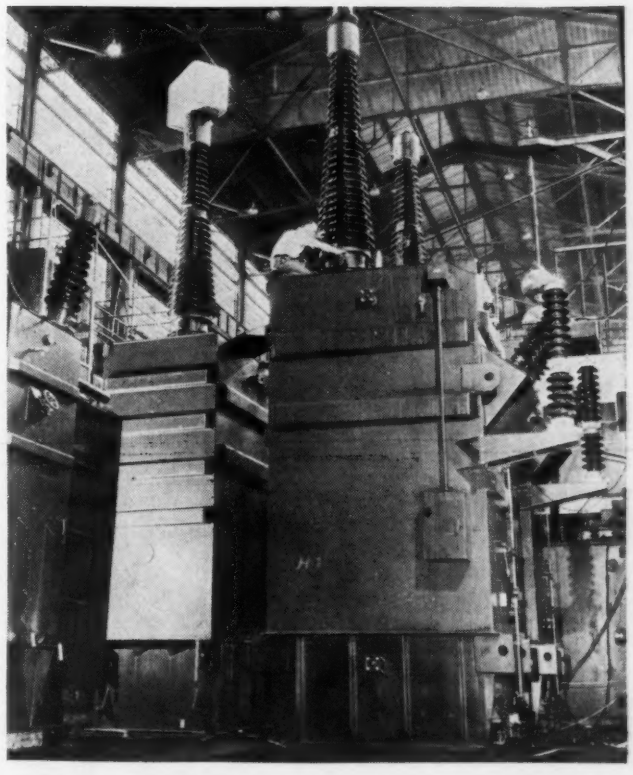
To end these worries, he suggested a new set of collective bargaining rules calling for persuasion instead of coercion, a change of attitude on the part of management and labor, the avoidance of punitive legislation which would bring strikes instead of peace, and the avoidance of fluctuations in our economy.

In a panel discussion of "Pricing Policies and Social Trends," Harold G. Moulton, president of Brookings Institute, said:

"The fundamental requirements for the successful operation of a capitalistic system may be stated as follows: back of each new unit of productive power there must be placed a corresponding unit of consuming power. The economies of mass production cannot be realized unless we have corresponding mass consumption. In any nation the ultimate stimulus for economic expansion is found in the unfilled desires of its population. The realization of these desires depends upon buying power as expressed in the relationship between wages and prices."

He advocated low prices and no increase in wages as the solution to present day problems.

Dexter Keezer, director of the economics department, McGraw-Hill Publishing Co., took the attitude that competition no longer can be depended upon to govern the division of the pro-



FOR 500-KV. LINE—Three transformers, built to step up current to as much as 500,000 volts — nearly 75 percent greater voltage than that now carried by any line — are shown in test pit of Westinghouse Electric Corp.'s Sharon, Ohio, plant. The transformers, 37 ft. high, are being built for American Gas & Electric Service Corp.'s experimental line near Brilliant, Ohio, being erected to determine the feasibility of transmitting power longer distances at greater voltages than ever before attempted

ceeds of economic activity under modern industrial conditions because of monopolization of large segments of the labor force and the concentration of corporate enterprise. "New principles which command general respect are needed. None has been developed."

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385 Manufacturers Exhibit at 17th Power Exposition

Many hundreds of products, among which was a sizable percentage of items shown for the first time, were exhibited by some 385 manufacturers at the Seventeenth National Exposition of Power and Mechanical Engineering at Grand Central Palace in New York. Four floors were taken up by the displays which were open during the annual meeting of the American Society of Mechanical Engineers, December 2 to 7.

A coal pulverizer having the screw-feed the only moving part was demonstrated by Blaw-Knox Co.; the coal is pulverized by self-abrasion in a blast of 750 F. superheated steam, the consumption being about 0.6 lb. of steam per lb. of coal. Five such recirculating units can pulverize 15,000 lb. of $5 coal per hour at an estimated cost of 4 cents per ton.

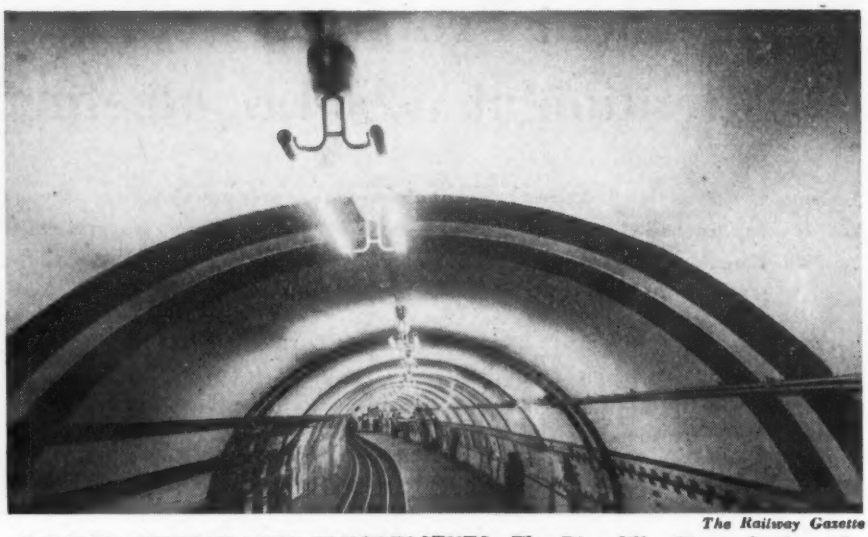
Bailey Meter Co. exhibited an oxygen recorder which charts the excess air in a combustion operation. Also shown was equipment for varying boiler feed pump speed by means of a hydraulic coupling controlled by a three-element Bailey control system.

Among four new adaptations of the Leeds & Northrup "Speedomax" was one showing load changes on a chart with quicker response than the customarily damped indicating instrument; it is electronic in principle and is aimed at disclosing the details of tie-line swings. A multiple-point voltage recorder in conjunction with thermal-converter telemetering shows 16 voltages in quick succession, thus facilitating voltage studies of distribution systems. Third item was a bearing temperature recorder affording 12 readings every 48 seconds. The fourth item is adapted to registering up to 50 temperatures in studies of boiler tube failures, etc.

An a.c.-operated "Megger Testing Set" giving 500 volts d.c. was shown by J. G. Biddle Co. along with a resonant reed frequency monitor.

Four new aids for laboratory testing use were displayed by Superior Electric Co. There was an apparatus for breakdown tests of up to 1,000-volt insulation which gives up to 3,000 volts and ½ amp., both continuously adjustable. A motor-driven auxiliary for "Hypot" testing provides voltage build-up at rates called for in A.S.T.M. standards.

Other items were a "volt-box" for convenient testing of meters up to 300 volts and 30 amp. and a "Powerstat Positioner" for remote control and indications.



The Railway Gazette

LONDON SUBWAY USES FLUORESCENTS—The Piccadilly Circus Station of the London subway system is the setting of this experiment in fluorescent lighting

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Northwest Group Plans Annual Spring Meeting

Pointing out that the present sellers' market can very rapidly change to a buyers' market, James H. Polhemus, Portland General Electric Co., president of the Northwest Electric Light and Power Association, told the Business Development Section planning meeting in Seattle, November 18 and 19, that this group should develop selling programs to be prepared for the time when real selling would be important to the industry.

The meeting was called by Henry R. Kruse, Puget Sound Power & Light Co., section chairman, to outline plans for the year with emphasis on the annual spring meeting of the section to be held in Seattle, April 30, May 1 and 2. Bureaus and committees were organized and programs of study and investigation were outlined for each.

Mr. Polhemus pointed out that with the resumption of the aluminum industry in the Northwest, power supply was not as plentiful as it was expected to be at this time, but there was no danger of a real shortage. We are going to have to do a better job in our territories than the P.U.D.'s and we will have to do this job in the face of rising costs, he said.

U-14 Brings Coal Savings of 18,750 Tons in 8 Cities

Electric utilities in eight cities reported to the Office of Emergency Controls that as a result of the first week of curtailment of service under Schedule I of CPA Order U-14 estimated reductions in energy output were 28,806,000 kw.-hr. and savings in coal, 18,750 tons.

Director Edward Falck expressed some disappointment as to the actual fuel savings reported by these cities and other areas but called attention to the fact that the figures released were for only the first week of the service curtailment. "Naturally," he said, "observance of U-14 was not complete during the first few days the order was in effect, but we are expecting much better results in the future."

A number of reports to OEC noted that the week after the issuance of U-14 was a period of varying weather conditions with storms in certain areas producing heavier heating and lighting loads on many systems. Reports from the eight cities follow:

City	*Reduction in Kw.-Hr.*	*Tons Coal Saved*
Detroit	1,800,000	900
Baltimore	3,200,000	2,080
St. Louis	900,000	650
Buffalo	1,260,000	630
Philadelphia	4,705,000	2,733
Chicago	12,391,000	9,182
New York	3,800,000	2,200
Boston	750,000	375

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New Louisiana Plant

Central Louisiana Electric Co., Alexandria, La., has announced that a 15,000-kw. gas-fueled steam plant will be erected as soon as a site is selected.

Engineers Rushing to Get Clark Hill Work Started

Bids for Part of Project Will Be Opened on December 10—FPC Has Not Yet Ruled on Utility Plans

Taking advantage of the latest increase in the President's ceiling on flood control expenditures, the Army Engineers are speeding construction of the Clark Hill reservoir, controversial multi-purpose project on the Savannah River in Georgia, it was learned this week.

On November 26, the day the Budget Bureau authorized the Engineers to spend an additional $70,000,000 for civil works ($55,000,000 for flood control and $15,000,000 for rivers and harbors) during fiscal 1947, the Army advertised for bids on several phases of the Clark Hill project. Bids for the west embankment of the dam and for steam diversion work will be opened December 10 and 11, at the District Engineer's office in Augusta. On December 26, bids for construction of the major portion of the dam will be examined.

Plans for the powerhouse have not been completed, but this work also will be pushed, Army sources advised.

Work by the Engineers at Clark Hill was halted in the planning stages last August by the President's curtailment of federal works spending. The Engineers announced that they could not carry on construction of Clark Hill and several other major projects under either the original flood control expenditure ceiling of $95,000,000 or the addition $40,000,000 authorized for this program in October.

Meanwhile, the Georgia Power Co. filed an application with the Federal Power Commission for a license to erect the Clark Hill dam with private funds. Early last month FPC held hearings in Atlanta on the company's application. Commission staff members still are studying this testimony.

The Engineers also are preparing to proceed with work on the Bull Shoals Dam on Arkansas' White River, another flood control project in which FPC and an electric utility have become involved. FPC has taken no action on the application of the Arkansas Power & Light Co. for authority to erect the powerhouse at Bull Shoals.

Bids for erection of this dam already had been taken when the project was halted last August by the construction "freeze." The contract now may be awarded to one of the bidders. Construction of access roads, clearing of land and other preliminary work already is under way.

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Supreme Court Refuses Okin's Appeal of 3 Cases

The Supreme Court recently refused to review three cases protesting an SEC-approved transaction between the Electric Bond & Share Co. and its subsidiary, American & Foreign Power Co. The actions were brought by Samuel Okin, a minority stockholder of E. B. & S., in an attempted appeal of a second Circuit Court of Appeals decision.

Okin sought to set aside SEC's approval of the refunding by E. B. & S. of a $35,000,000 indebtedness owed it by the subsidiary company with a 4 percent reduction in interest. SEC sanctioned this plan on condition that none of the debt be retired by American without specific SEC approval. The commission also provided that the rank and status of the debt remain unchanged until finally determined by SEC. Okin claimed this was an assertion of injunctive authority which could not be legally exercised by SEC.

Illinois Cooperative Gets Injunction against Union

Illinois Rural Electric Co., an REA cooperative with headquarters at Winchester, has obtained an injunction from Circuit Judge Clem Smith to restrain the International Brotherhood of Electrical Workers, A.F.L., from interfering with the operation of the co-op, which has refused to submit to the union's demand for a union shop.

The injunction was granted after co-op officials testified to a fight between its non-striking workers and the strikers and to other acts restricting the operation of the co-op. No date has been set for a hearing.

On September 26, a group of 14 linemen and groundmen walked out when their demands for a union shop were denied. Most of them got work elsewhere but returned in the middle of November and asked for their old jobs, but unsuccessfully renewed their demands for a union shop.

On November 14, a fight occurred between the strikers and a line crew near Athensville. The company swore out warrants charging the 14 with a "riotous act," and the men were arrested but released later under $500 bonds furnished by the union.

Service to about 800 farms, in addition to other customers, was interrupted for about twelve hours on the night of November 19, when two poles in isolated sections in Morgan and Scott Counties were sawed through and permitted to fall. Though the company declared that the damage was done by someone familiar with the system, William Boyd, business agent for the union, denied that the union had anything to do with the "acts of vandalism."

Defendants named in the injunction order issued by Judge Smith include the 14 strikers, Mr. Boyd, Roscoe Tol-

PRACTITIONERS OF SAFETY—The General Safety Committee of the New England Power System pose at Millbury, Mass., at a meeting at which they learned that in the past 13 years 40 percent of the National Safety Council's Public Utilities Section awards have been conferred upon N.E.P. System companies for perfect records, that is, no disabling injuries to employees for twelve months. Of the 166 perfect records among utilities reported to the Council from 1933 to 1946, 67 were from New England companies. Among large utilities in 1945-46, the Narragansett Electric Co., Providence, R. I., was the winner

liver, assistant business agent, and "unknown members" of that local union. In its complaint, the company also charged interference with access to a building of the cooperative, threatening of non-striking workers with personal harm, and other acts.

The injunction, which permits peaceful picketing, prohibits any hindering or intimidation of workers, by force or otherwise, and even by the use of "insults;" attempts to prevent work of the co-op from being carried on; violence or threats to the members of the families of employees; congregating near establishments of the co-op; damage to any of its lines or other property; interruption of electrical service; and interference with the hauling of fuel oil or other materials or equipment.

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Canadian Utility Satisfied with Government Seizure

No objection will be raised by the British Columbia Electric Railway Co. to expropriation by the British Columbia Power Commission of its assets in the northern Vancouver Island and Kamloops area, according to A. E. Grauer, president of the company, who stated that these units were a geographical natural and distinctly separate from the main power distribution system of his company.

He added that his company had found it necessary to purchase power from neighboring saw mills and that further installation of power plants would have been necessary.

Other properties to be taken over by the commission are the generating and distribution system at Port Alberni and Alberni, owned by National Utilities Corp., an Electric Railway subsidiary; the distribution systems at Parkersville and Qualicum, also owned by National; and the distribution system at Royston, owned by Royston Light & Power Co., a National subsidiary. The price of the properties will depend upon appraisals made after the commission takes them over on January 1.

When these are included in the commission's system, it will be serving the whole of Vancouver Island, north of the Victoria district, with the exception of the Canadian Collieries operation which serves the Courtenay-Cumberland area.

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New Plant Bonds Defeated

Voters in Sturgis, Mich., which operates its own municipal plant, recently defeated a $1,000,000 bond issue to finance a new plant.

Utilities Associations Will Send Officers to Meeting

Representatives of the Edison Electric Institute, the American Gas Association, and the American Transit Association will attend the meeting at Washington called for December 9 by Director Edgar L. Warren of the United States Conciliation Service, wherein attempts will be made to find more effective means of resolving labor disputes affecting public utilities. Leaders of national unions representing utility workers also are expected to attend.

President Grover Neff, of E. E. I., and H. K. Breckenridge of the West Penn Power Co., chairman of E. E. I.'s Industrial Relations Committee, will represent E. E. I. Managing Director H. S. Bennion may also attend. A. G. A. will be represented by Col. Hudson W. Reed, president of the Philadelphia Gas Works and an A. G. A. vice-president, and by Fred L. Rauch, vice-president of the Cincinnati Gas & Electric Co. A. T. A.'s representatives will include George Anderson, head of its Labor Relatons Committee, and Walter A. Draper, president of the Cincinnati Street Railways Co.

Neff and Breckenridge, it was made clear, will attend without authority to speak for E. E. I.'s member companies or for the electric power industry. No meeting of E. E. I.'s directors was held before the meeting. Both A. G. A. and A. T. A. officials indicated that they had prepared no programs to be presented at the meeting, in the absence of sufficient time to do so and of crystallized sentiment among their members. A. G. A. directors, however, were to meet this week and discuss the problems posed by Warren's invitation.

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Alien Patents Available

A 4,000-page book containing summaries of all the mechanical and electrical patents of enemy nationals which were seized by this country in the war is being offered by the Office of Alien Property, Department of Justice, Washington 25, D. C., at $10 a copy. Most of the patents are available to American business for a $15 administrative fee on a royalty-free, non-exclusive licensing basis for the remaining life of the patent.

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Surplus Property Sales Will Be Studied at Meeting

Representatives of the public utilities industries will meet in Washington on December 12 to confer with War Assets Administration and other federal agency officials on the disposal of surplus government property.

The conference has been called by L. Gray Marshall, deputy director of the Industrial Division of WAA's real property disposal office. Other WAA staff members and representatives of the National Housing Agency and Federal Works Agency will participate.

Purpose of the conference, Mr. Marshall explained, is to clarify WAA's plans for disposal of surplus property in which public utilities are especially interested. This will include both the permanent disposal of utility systems and the disposition for off-site use of utility facilities at all types of surplus plants, he said.

The following individuals and organizations, from electric utility fields, both public and privately owned, have been invited to attend: H. S. Bennion, Edison Electric Institute; J. W. Pyles, Rural Electrification Administration; Don Worth, Bonneville Power Administration; C. Wessenauer, Tennessee Valley Authority; Jerome L. Watson, Florida Power Corp.; Robert H. Fite, Florida Power & Light Co.; Fred A. Compton, Detroit Edison Co.; R. C. Wenz, Duquesne Light Co.; Ernest R. Mitchell, Cincinnati Gas & Electric Co.; Philip Sporn, American Gas & Electric Service Corp.; C. W. Jones, New England Power Co.; Alex Bailey, Commonwealth Edison Co.; W. E. Mitchell, Georgia Power Co.; M. B. Covell, Union Electric Co. of Missouri; Charles E. Kohlhepp, Wisconsin Public Service Corp., K. M. Irwin, Philadelphia Electric Co.; E. A. Yates, Commonwealth & Southern Corp.; W. L. Collins, Buffalo Niagara Electric Corp.; W. P. Reilly, Ebasco Services, Inc.; R. L. Thomas, Consolidated Gas, Electric Light & Power Co. of Baltimore; Cecil Sanders, Virginia Electric & Power Co.; J. D. Enefer, Southern California Edison Co.; Paul W. Clements, Columbus & Southern Ohio Electric Co.; Frank E. Baxter, Pacific Gas & Electric Co.; John Talley, Southeastern Electric Exchange; J. C. Parker, Consolidated Edison Co.; H. L. Buckley, Gilbert Associates, Inc.; F. C. McKrell, Stone & Webster Engineering Corp.; and a representative of Wisconsin Electric Power Co.

MEETINGS

Canadian Electrical Association—Winter conference, Chateau Frontenac, Quebec, January 13-15. B. C. Fairchild, managing director, 704 Tramways Building, Montreal, Canada.

Agricultural Development Clinic—Fairmont Hotel, Fairmont, W. Va., January 24-25. Roy W. Godley, Rural Service Manager, Edison Electric Institute, 420 Lexington Ave., New York 7, N. Y.

American Institute of Electrical Engineers—Winter meeting, New York, January 27-31. H. H. Henline, secretary, 33 West 39th St., New York 18, N. Y.

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

ATLANTIC CITY ELECTRIC CO. has received commission approval of its application to change its outstanding 1,150,000 common shares, no par, into a like number of common shares, $10 par. The commission also authorized the utility to issue all the new $10 par shares to American Gas & Electric Co. in exchange for its holdings of all outstanding no par shares. (Release No. 6989).

INTERSTATE POWER CO., Dubuque, Iowa, has been authorized to issue and sell $600,000 principal amount of one-year promissory notes. The money will be applied toward the company's construction program. The proposed financing is of a temporary character pending approval of the company's reorganization plan. (Release No. 7001).

ASSOCIATED ELECTRIC CO. has been authorized to loan its subsidiary, Manila Electric Co., up to $1,000,000 for property rehabilitation made necessary by the war. The loan, without interest, will be in addition to $2,500,000 which Associated previously was permitted to advance to Manila. (Release No. 7013).

KANSAS CITY POWER & LIGHT CO.'s proposal to refinance its outstanding bonds and preferred stock through issuance of new bonds, serial notes and preferred stock has been approved. Kansas City Power & Light, a subsidiary of Continental Gas & Electric Corp., plans to sell at competitive bidding $36,000,000 of first mortgage bonds, due 1976, and 100,000 shares of $100 par value cumulative preferred stock and to sell $4,000,000 of 10-year serial notes to commercial banks. With the proceeds the company will redeem its outstanding $38,000,000 of first mortgage bonds, 3¾ percent series, due in 1966, and 40,000 shares of no-par-value $6 first preferred stock, Series B. Kansas City also intends to amend its articles of incorporation to reclassify certain of its authorized but unissued shares of first preferred and participating preferred stocks into 200,000 shares of cumulative preferred and 110,000 shares of common stock. (Release No. 7017).

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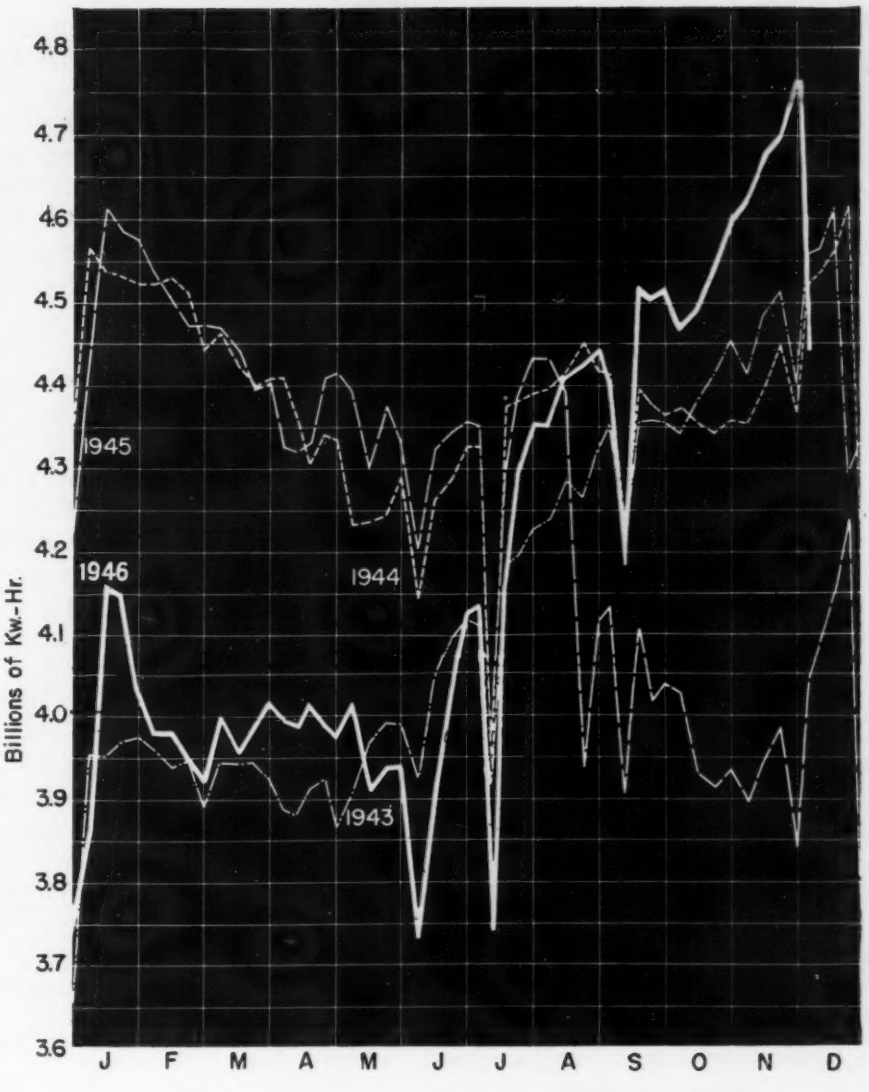
Kentucky Law Upheld

Kentucky's statutes under which the Frankfort Electric & Water Board operates and city ordinances placing municipal utilities under its direction, were upheld recently by Circuit Judge W. B. Ardery at Versailles.

Under the law, the board is an independent body free of control by the city council, the board has rate-making power, and utility funds cannot be diverted for other uses by the city.

The constitutionality of the law was challenged by two city councilmen who indicated that an appeal will be made.



Coal Strike Drops Output Curve Sharply

Curtailment regulations following the coal strike, coupled with the Thanksgiving Day holiday, sent the electric output curve precipitously downward during the week ended November 30, 1946, according to figures released by the Edison Electric Institute.

The amount of electrical energy distributed by the light and power industry during the week amounted to 4,448,193,000 kw.-hr., comparing with 4,764,718,000 kw.-hr. during the week ended November 23. Output for the comparable week of 1945, that ended December 1, totaled 4,042,915,000 kw.-hr., this year's figure representing an increase of 10.0 percent.

For the first time since early August one of the seven major geographic regions of the country reported a decrease as compared with the corresponding week of the previous year—the Mid-Atlantic group with a drop of 0.1 percent, attributable, no doubt, to the strike. All sections showed substantial decreases as compared with the week ended November 23, when the over-all percent change for the country amounted to a 24.0 percent increase.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
Nov. 30	4,448	Dec. 1	4,043	Dec. 2	4,524
Nov. 23	4,765	Nov. 24	3,841	Nov. 25	4,369
Nov. 16	4,700	Nov. 17	3,985	Nov. 18	4,450
Nov. 9	4,682	Nov. 10	3,948	Nov. 11	4,397
Nov. 2	4,628	Nov. 3	3,899	Nov. 4	4,355
Oct. 26	4,602	Oct. 27	3,937	Oct. 28	4,358
Oct. 19	4,540	Oct. 20	3,915	Oct. 21	4,345
Oct. 12	4,495	Oct. 13	3,934	Oct. 14	4,355
Oct. 5	4,478	Oct. 6	4,028	Oct. 7	4,375
Sept. 28	4,518	Sept. 29	4,039	Sept. 30	4,366
Sept. 21	4,507	Sept. 22	4,019	Sept. 23	4,377
Sept. 14	4,521	Sept. 15	4,106	Sept. 16	4,395

Percent Change from Previous Year

	Nov. 30	Nov. 23	Nov. 16
New England	+ 0.1	+21.9	+10.6
Mid-Atlantic	— 0.1	+15.6	+ 9.0
Central Industrial	+ 6.8	+21.2	+16.0
West Central	+ 6.7	+16.3	+11.3
Southern States	+20.9	+32.1	+28.3
Rocky Mountain	+ 8.3	+18.8	+13.9
Pacific Coast	+21.7	+35.7	+26.5
Total United States	+10.0	+24.0	+18.0

Electrical World OPINION

Is Electric Service Really Cheap?

NO INCALCULABLE harm is done when it is asserted that electric service is cheap. It has done the utility industry a lot of good, on the contrary, to keep hammering on the concept that electricity costs very, very little when measured against its benefits. The question here is whether the word "cheap" is the best word to use in this connection. The argument can verge close on being a quibble. But there are nuances about the word that raise some doubt regarding the entire wholesomeness of the flavor it leaves.

Electricity is positively inexpensive, it is a bargain, it is not dear, it costs little, it delivers more than its money's worth, it is more than reasonable in price. But is it "cheap" in the sense that common usage has set up for the word? Webster's dictionary says, in addition to the low-price significance, that cheap means shoddy, of inferior quality, of small intrinsic worth, despicable, contemptible. Phrases carrying out these connotations are in common use; "a cheaper class of customers," "stooping to win cheap applause" and "it was a cheap, low-down trick." A person even feels "cheap" when he is abashed or discomfited. The word "cheapening" has little of the altruistic about it.

With all these detractive meanings lurking in the minds and parlance of the public, is it the best of policy to refer to electric service as cheap? It costs remarkably little but there is little about it that is "cheap." High-toned and high-principled canaries are said to refrain from singing in any notes that even approximate the "cheap, cheap" of lesser birds. Maybe they sense intuitively that they would degrade themselves if they should make such a slip.

Purchasers Can Use Some Priority Scheduling

WITH the present shortages in material and equipment and the year and more delivery promises, it may seem unnecessary to give much attention to excessive inventory. There are straws in the wind, however, that give a warning of inventory inflation and adjustment ahead. An artificial demand has been built up by doubling on orders and duplicating sources of materials, but that is not all of the danger.

Orders to "send a carload" given to two suppliers in the hope of having at least some shipment are causing the inflation. Orders to "substitute if necessary" are often justified when a particular item is delaying completion of a job for which other materials are on hand or in sight. Similar orders to fill the stock rooms are not justified. Accepting wire beyond the equivalent supply of hardware, and adding to the stock of transformers when there are not enough insulators for the jobs ahead are in this class of unbalanced buying.

Styles and types of hardware and clamps and sizes of wire are being used even though they may not always be in the particular company construction standards and usual lists of materials. As soon as the items regularly specified are available, will the engineers still list these sizes? Will the construction forces take them in place of the sizes and kinds they normally requisition?

Demands are pressing the purchasing director now, but if all his orders are filled will he have more than the total of his requisitions from the construction forces? Or, will he have a larger stock of a certain size wire, with the line for which it was ordered already completed?

No one would want a return of the war-time priorities system even though it did serve in the same situation that prevails now. Just a little of the priority thinking on the part of every purchaser during the next few months may be a help when adjustment time arrives.

A Self-Excited Alternator?

DIRECT CURRENT generation and distribution have been generally abandoned because alternating current had so many points of superiority. But there was one inherent attribute of the d.c. generator that the alternator lacks and that is the possibility of compounding for better voltage regulation. If that missing attribute could be retrieved by the a.c. machine it would make a profound difference in the a.c. system, at least at the power house and probably well along to and into the substations. Just to achieve the merit of self-excitation, even without compounding, would be something. Maybe it will never be done but it is intriguing to assume the impossible and evaluate the consequences.

Small alternators have been rendered self-exciting by superposing a d.c. winding and commutator on the rotating armature. The British report making many such machines and they have even incorporated the compounding characteristics in some of them. The rotating field commonly used in the larger alternators interposes some formidable difficulties in trying to generate the excitation requirements within the same framework even if there were no scruples about scrambling 11 kv. with 220 or 440 volts in such close intimacy.

There would probably be no point in envisioning such self-excitation unless the problem of automatic compounding were solved first; that is because the fairly inherently poor regulation of the alternator would mean

a loss in voltage performance unless over-compensation were provided. The very time lag of the heavy fields would be another obstacle.

There are many things that can be done with small units that cannot always be done feasibly and justifiably with the large ones. But is it necessary to assume that self-regulation with a margin of voltage to offset system drop is a completely impractical thing to canvass in the light of what it might win in system simplicity if it could be done practicably with turbo-alternators? Practicably would hardly be enough—it would have to deliver something substantially better in cost, losses and upkeep than the best of the excitation and regulation systems now in service. That would be a tough assignment for the inventor who might be inspired by this excursion into conjecture-land.

Competition and Confidence Create New Ceilings

OPEN PRICE CLAUSES in otherwise firm quotations have been a source of considerable concern to electrical equipment purchasers. While these escapes for the seller are a seemingly natural outgrowth of present unsettled labor and material costs, they are one-sided in application. They leave a blank check agreement to pay the sellers' costs now that price controls have been removed.

On the other hand, a firm price for delivery promises beyond one year and even up to two or three years, in the present unsettled situation, would of necessity have a considerable percentage for contingencies and possible increases. No manufacturer can foresee with certainty now what his costs may be in 1948. Possibly no large change will be experienced, or it may be 10 percent or maybe more. Not only his own labor costs but also all of his supply materials are involved in the uncertainty.

Escalator clauses and formulas for determination of fair percentage would be complicated and could lead to as much negotiation as open prices. It is unfortunate that all protective coatings must be on one side, and that all the steps in the chain of supply are accumulated for the utility and other users to add to their budgets and work order costs. The realistic question is, however, where else can they be added?

There is only one protection on the other side of this situation. It goes under various names—competition, good will and confidence in a free enterprise system. The electrical industry is fortunate in this respect. It is built on firm foundations of square dealing. Manufacturers in the business of supplying electrical equipment are not overnight transients. They too have huge investments and long-range views. They expect to be in business many years after the present year or two and they hope to deal with the same purchasers. That is the best escalator base, the only ceiling that is practical. It seems not at all likely that there can be any runaway in the normal relations of prices of electric equipment.

WASHINGTON COMMENT

By R. N. LARKIN

OUTSIDE LIMITS in the forthcoming battle of the federal budget are close to $25-$30 billion, as a Republican goal, and proposals not exceeding $36.6 billion as an Administration program.

The Budget Bureau reconciles its trial balances at about $36.6 billion. Presidential pressure aims at reducing the figure below $35 billion. The task embraces the "frozen" part of the budget and the "controllable" remainder. The former includes debt service, veterans' commitments, tax refunds and defense needs; the latter foreign loans, agricultural programs, relief and social security, public works, and routine government.

Interest on the public debt is fixed for years to come at $5 billion. Veterans' programs have peaked temporarily and should decline from this year's high of $6.2 billion to $5 billion, or perhaps $4 billion.

The military services are under pressure to lower their budgets from this year's $18.5 billion. Resistance has been justifiably vigorous. Consequently, no reduction is envisaged below $17 billion.

In tax refunds, next year's figure is expected to run about half a billion, well under this year's $1.8 billion. All these indicate a "frozen" budget of $26.5 to $27.5 billion.

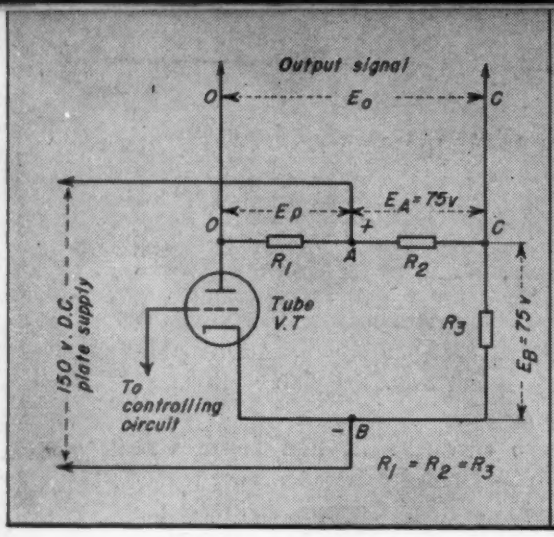
Proportionately, the "controllable" budget will yield less. Without expansion of existing foreign loan authority, present commitments, including the British loan, make it difficult to keep this item below $3 billion.

It seems safe to predict that aids to agriculture next year will equal this year's total of $1.2 billion, and perhaps increase to $1.5 billion. Social security, relief and retirement pensions should remain at $1.2 billion.

While public works spending seems a likely place to chop, possibilities here are limited by the intense resentment generated in Congress and in the states by any attempts to do so. Since Mr. Truman's August construction curtailment, five increases, totalling $175 million, have been made in the ceilings then imposed upon the Army Engineers and the Reclamation Bureau. A sixth, amounting to perhaps $20 million, came through an "interpretation" of the economy directive. Thus, public works spending next year, far from declining, is expected to rise to $1 or $1.5 billion, from this year's total of $900 million.

Savings from the "General Government" item are unimpressive. Some see $200 million saved here, bringing next year's total to $1.7 billion. Miscellaneous savings as high as $400 million leave this item at $200 million. These leave a controllable budget of $8.3 to $9.1 billion, and a total of $34.8 to $36.6 billions.

The difference between these figures and the G.O.P.'s $25-$30 billion budget is, as Washington sees it, strictly a Republican problem.



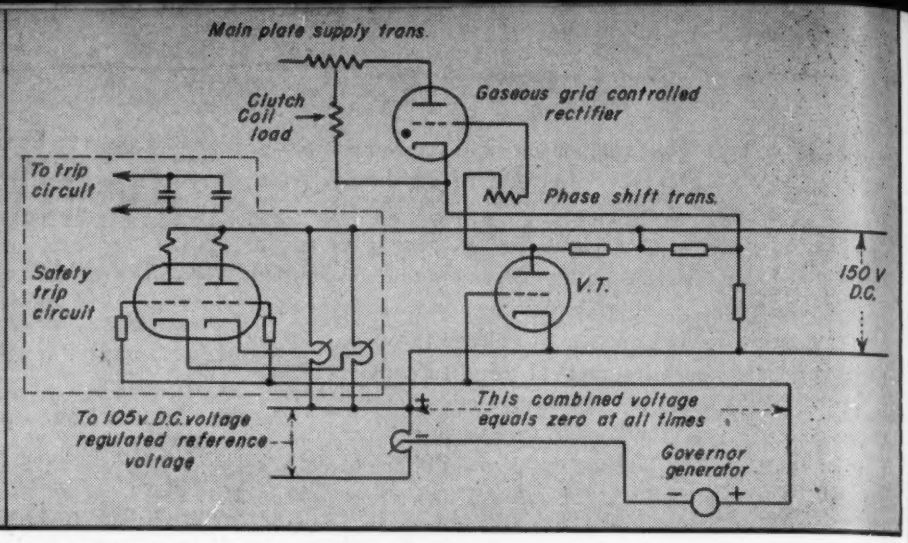


FIG. 6—Vacuum tube bridge circuit (left) which acts as controlling element for operating thyratrons feeding the magnetic clutch . . . (right) FIG. 7—Schematic of amplifier system (right). Speed control potentiometer shown connected across a voltage regulator reference system. The position of this potentiometer determines the running speed. The generator is then connected in series opposition with this voltage so that when operating at identical speeds, the sum of these two voltages equals zero. The safety trip system is connected in the same circuit

Reliable Electronic Controls *for* FAN *and* STOKER DRIVES...II

D. L. GREENE, *Elec. Engr., Gilbert Associates, Inc., Reading, Pa.* and
R. L. JAESCHKE, *Elec. Engr., Dynamatic Corp., Kenosha, Wis.*

BASIS FOR the electronic control decisions at Jennison Station were set forth in the preceding instalment which appeared in the November 23, 1946, issue of ELECTRICAL WORLD. Details of functioning of the components are given herewith.

Thyratron output conforms to desired excitation in response to boiler variations—Safety trip circuit transfers electronic functions to emergency cabinet to supplement duplication of tubes for sake of continuity

Electronic Control System

Voltage output from this rectifier filter system, fed by the governor generator, is thus proportional to the output speed of the machine. Slight variations or changes in speed will result in proportionate changes in the output voltage of the generator system and such variations may be used to regulate the clutch mechanism to control the speed of the output shaft. The necessary regulation and control is effected in the electronic circuits by comparing the voltage output of the governor generator system with a standard reference voltage which may be adjusted manually to give the desired speed.

The electronic control circuit is essentially a controlling rectifier using thyratrons whose power output varies the excitation to the windings of the clutch. Power is furnished the plates of these gaseous rectifiers from an a.c. source. The grids or controlling elements of these tubes are fed from a speed actuating device, in this case an amplifier integrating system.

The grid of the amplifier tube is controlled by two variable electrical devices:

1. The speed setting potentiometer which sets a voltage that is proportional to the speed desired.
2. A voltage from the governor generator which must be equal to the voltage set by the speed controlling potentiometer.

When these two devices are equal, a balance exists in the control system. Any slight deviation will cause the amplifier to respond, correcting any speed changes. Should the clutch output speed diminish slightly, the grids of the output thyratron would become more positive, thereby allowing increased current to flow into the clutch field coil. The potentiometer voltage and governor generator voltage are then connected in series opposition and are of such a magnitude that the signal voltage to the grid of the amplifier is approximately zero when the output shaft is operating at the desired speed. The signal voltage will be positive when the output shaft rotates faster than the desired speed, and will be negative for speeds slower than the selected value.

The output of the amplifier then reverses the polarity sequence when its grid is positive and its output is negative.

The reference voltage is obtained from a conventional transformer rectifier filter system operated from the line. Voltage stability is obtained through the use of voltage regulator tubes of the VR-105 or VR-150 type. The closer the reference voltage is held to a predetermined value, the better will be the speed control of the machine. The output of this reference voltage is connected to the manually or lever operated speed control potentiometer. It provides a convenient means for adjusting the machine to its required speed. The sum of the two voltages, reference and governing, is then brought to the triode of the amplifier tube arranged as a driver for the final rectifying tubes.

Amplifier System

This system is shown schematically in Fig. 6. Resistances R1, R2 and R3 are equal. 150 volts is applied to A and B with A positive and B negative. The voltage drop across R2 and R3 are equal since their resistances are equal, in this case 75 volts across each. If the triode VT is not conducting, the signal voltage developed across OC equals 75 volts. When the triode VT is conducting completely, 75 volts will appear at OC but in opposite polarity. The voltages will be as follows: With the triode conducting E_P equals 150 volts, O is negative, A is positive. E_A equals 75 volts, A is positive, C is negative. E_P plus E_A equals 75 volts negative. With the triode not conducting, E_P equals zero, E_A equals 75 volts with A positive and C negative. OC, or the voltage developed at E_o, equals 75 volts positive. R1 offers no impedance since no actual current flows in this system. In the more complete electronic speed control diagram shown in Fig. 4, this amplifier system is noted as a speed integrator. Fig. 7 shows a schematic diagram of the entire system.

Safety Trip Circuit

When the voltage developed by the generator and the potentiometer is at zero, with the machine running at the desired speed, a system to indicate failure was set up by using relays that are sensitive to a voltage deviation at this point. Should this voltage vary more than one-tenth of a volt, a speed deviation of approximately 10 rpm. results. The failure of any component part would result in over or under speed of the machine, which is an excellent means of determining if a failure has occurred. A dual triode is used for this purpose with small sensitive relays installed in the plates of their respective tube halves. One relay has normally closed and the other normally open contacts. The tubes are so biased through the use of potentiometers in their cathode leads that one grid is slightly more positive than the voltage developed from the potentiometer and the governor, and the other slightly negative.

The relay with normally closed contacts is in an energized position normally, since the grid is positively biased, and holds its contacts open. Should the governor generator decrease its voltage, the grid of this tube would become negative, decreasing the flow of current through the relay, which would cause the relay to drop out and actuate the transfer system.

The other half of the trip mechanism operates on an increase in speed. Should the governor generator increase its speed, its grid would become more positive, causing the tube to conduct, allowing the relay to pick up and actuate the transfer system. To prevent unnecessary or false transfer of the controls due to the inherent inertia of the magnetic couplings, it was necessary to insert a timing mechanism in series with the transfer system. The sensitive trip relays start a timer which in turn actuates the transfer relay and transfers the complete control to the spare cabinet. This is due to the fact that it requires up to 5 sec. for the machine to accelerate to speed and a similar time for de-acceleration to take place.

In addition to the above circuits, the following additional refinements were built into the equipment to insure smooth operating results.

The output of the amplifier is fed

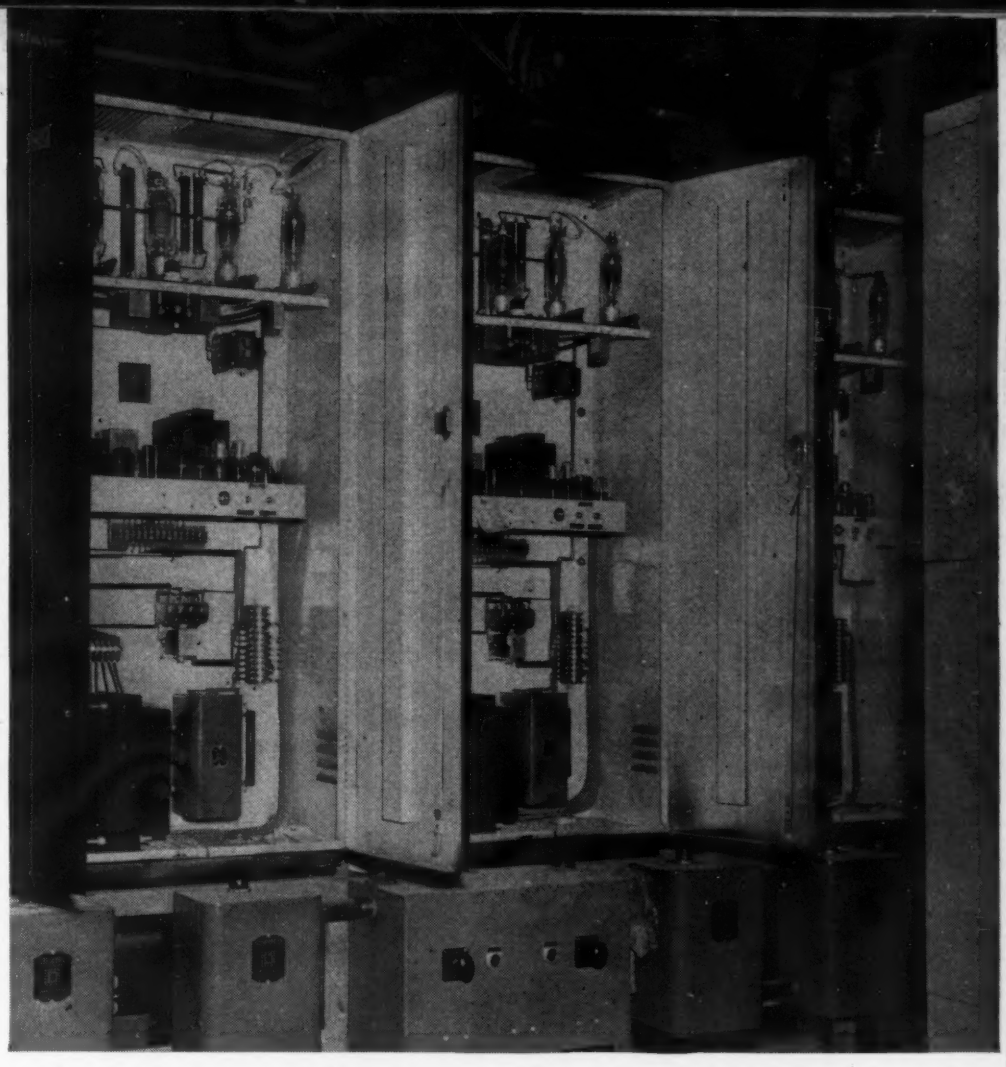


FIG. 8—Main Dynamatic electronic control cabinet with transfer relays and four magnetic contactors in field leads

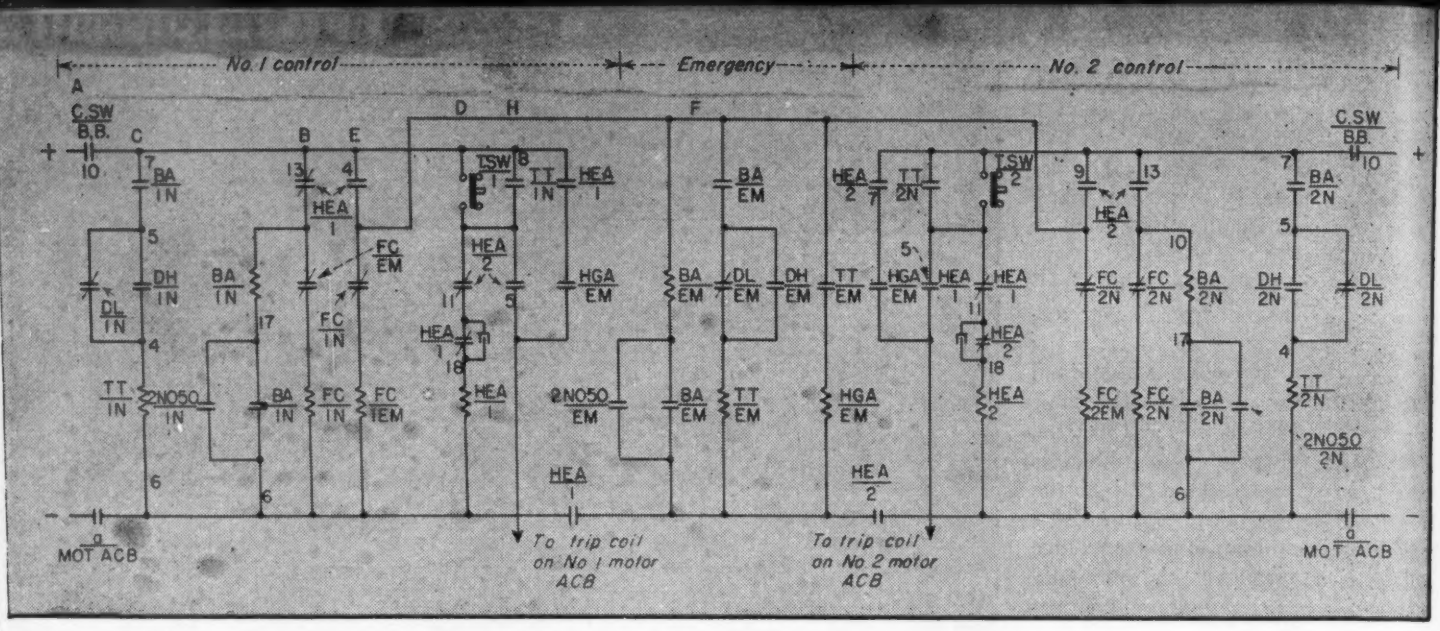


FIG. 9—Throwover control diagram (in schematic form) for magnetic couplings.

A.C.B. · · · Air Circuit Breaker

a · · · Aux. switch closed when A.C.B. or contactor is closed

b · · · Aux. switch open when A.C.B. or contactor is closed

BB · · · Boiler board

C.SW. · · · Control switch

MOT. · · · Motor

SWGR. · · · Switchgear

10 · · · Contact on C.SW. stays closed on closing

$\frac{\text{T. SW}}{1}$ & $\frac{\text{T. SW}}{2}$ · · · Manual transfer switches 1 & 2

$\frac{\text{F.C.}}{1N}$ & $\frac{\text{F.C.}}{2N}$ · · · Field contactors — Normal 1 & 2

$\frac{\text{F.C.}}{1EM}$ & $\frac{\text{F.C.}}{2EM}$ · · · Field contactors — Emergency 1 & 2

$\frac{\text{HEA}}{1}$ & $\frac{\text{HEA}}{2}$ · · · Transfer relays — Hand reset (shown in reset pos.) 16 point (9 N.O. & 7 N.C. contacts)

$\frac{\text{HGA}}{\text{EM}}$ · · · Aux. relay

* BA · · · Contactor (plate circuit)

* DL · · · Sensitive differential relay (low)

* DH · · · Sensitive differential relay (high)

* TT · · · Transfer time

* 2N050 · · · Tube type timer (20-sec. delay drop out — 50-sec. pickup)

Note—* Indicates equipment located in electronic cabinet

Note—All contacts shown in deenergized position

through a series anti-hunt system which consists of a resistor and condenser connected in parallel. The values of these two components in electrical time are equal to that of the machine time constant so that hunting is materially reduced. The success of such an electrical-mechanical system depends upon the timing of this anti-hunt circuit. Without this circuit it would be necessary to make the system very broad or inefficient with the result that the fine speed control characteristics would be lost. This method has been found very effective and does materially reduce overshooting and undershooting when a speed control change is made.

Phase Shift

After the anti-hunt system, the circuit follows through to a phase shifting system whose output voltage is connected in series with a 90-deg. out-of-phase a.c. voltage, and causes the grids of the thyratron to be smoothly modulated. This a.c. voltage is varied off its axis through the addition of the d.c. signal voltage from the amplifier which causes an effective phase shift to the grid system, thereby allowing the thyratron to be fired over different parts of the cycle.

Tube Types

The gas-filled type of grid controlled tube was chosen because of its many advantages over the mercury type. Its cost is somewhat lower, it is smaller since it does not require a cold spot for condensation and primarily its grid characteristics do not change as in the case of a mercury tube. Temperature changes have little or no effect on the envelope of this type of rectifier and recent developments with gaseous (xenon gas) tubes have proven their life to be as long as the mercury type of tube with improved stability and, since stability is required in power plant operation, these features were deemed very important. Short warm-up time is also very desirable as in cases of power interruption, where an extremely short warm-up time is necessary so that the power plant itself is not shut down due to lengthy warm-up periods caused by recycling timers.

Operation of Transfer System

The schematic diagram shown in Fig. 9 shows the sequence of operation of the transfer system. The Emergency Control is an exact duplicate of the No. 1 and No. 2 control with the exceptions noted in the center or emergency section.

Closing the motor air circuit breaker starts the main motor and supplies 220-volt a.c. power to the electronic cabinets as shown on Fig. 2. It also energizes the transfer system controls through contact 10 of the motor air circuit breaker control switch and an "a" switch on the motor A.C.B. as at point "A" (Fig. 9).

Power at the cabinet immediately heats up the 2NO50 tube which, after a time delay of 50 seconds, closes its contacts and picks up the "BA" con-

tactor as shown at point "B." This contactor seals itself in through contact 13 of the HEA (Transfer) relay and establishes the circuit to the thyratron tubes and sets up the transfer circuits shown at "C." Contact 13 also supervises the pick-up of the main contactor in the field circuit of the magnetic clutch through an auxiliary contact on the emergency contactor to the same clutch circuit.

The electronic equipment is now in normal operation and the transfer system is set to operate with an operation of the "Safety Trip Circuit."

Safety Trip Circuit

Operation of the sensitive (Differential) relay contacts (Point C) DL or DH, energizes the timer "TT" through "BA" contacts noted above, which after a predetermined time (approximately 5 sec.) closes its contacts as shown at point "D." This contact energizes the HEA (Transfer) relay which is an electric trip—hand reset relay. The Manual Transfer Switch (T. Sw.) will also initiate the transfer the same at the "TT" relay. This transfer is initiated only if the No. 2 clutch is operating from the No. 2 electronic control cabinet, i.e., neither control can transfer to the emergency cabinet if the other is operating from this cabinet.

Operation of the HEA (Transfer) relay closed No. 4 contact (Point E) and picks up the emergency field circuit contactor, through an auxiliary contact on the normal field contactor, which has dropped open, and transfers the clutch field to the emergency supply. The transfer relay also energizes the emergency control circuit through contact 17 and permits the emergency electronic supply to function.

Operation of the DL or DH relays in the emergency cabinet (Point F) energizes a similar timer "TT" relay which after a predetermined time operates an HGA (Emergency Trip Relay) (Point G) and trips the main motor A.C.B. (Point H). (Note the closed contact on the DL relay which is held open under normal operation). Note at Point "H" the HGA emergency trip relay can trip the motor A.C.B. only if the HEA transfer relay has operated. Also note that if the No. 2 clutch is operating on the emergency cabinet the contacts of the No. 2 HEA relay has opened the No. 1 HEA coil circuit and set up a direct trip of the No. 1 motor A.C.B. from the No. 1 timer "TT." This means that in case the No. 1 control attempts to transfer, when the No. 2 controls are on the emergency controls, it will trip the main No. 1 I.D. fan motor A.C.B. directly.

Experience Favorable

Field tests of the magnetic couplings and their electronic controls have shown very good results in maintaining any speed within the operating range of 0 to 570 rpm. with an accuracy of one-tenth of 1 percent. The full load speed of the 450-hp. motor is 585 rpm. with approximately 3 percent slip in the magnetic coupling resulting in approximately 570 of the fan. The quick response without hunting is an inherent characteristic of this control and maintains a very desirable boiler operation.

The Jennison plant has been in operation several months and a few unfortunate failures have occurred in the electronic equipment, but in every case the safety trip and automatic transfer system has functioned with no change in boiler operation, the only indication the operator or anyone else having of the transfer being the signal provided.

The use of vacuum tubes in power plant equipment always brings up the problem of tube failure, as most tubes are the radio type and do not carry the reliability required in power plant application. Duplication of tubes in the past has been a partial solution; however, this is far from satisfactory. Tube failure is always high in the first 50 hours of operation and when certain tube types fail, a short exists causing the entire circuit to become inoperative. It is felt that a higher grade tube, more conservatively rated than the present day standards, would establish a much larger safety factor and is definitely needed in power plant and other fields where continuity of operation is of prime importance.

If the tube continues satisfactory operation after the first 50 hours, then the accepted practice is to change tubes after a predetermined number of hours' operation. In the system described above this may be conveniently done by manually transferring either control to the spare cabinet or the tube may be left in operation until it fails and causes an automatic transfer which will undoubtedly result in a saving over a period of time. Local conditions will govern the best method to obtain maximum operating reliability.

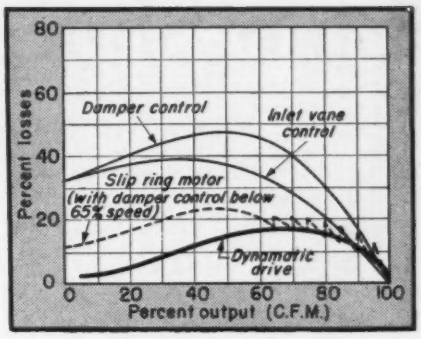
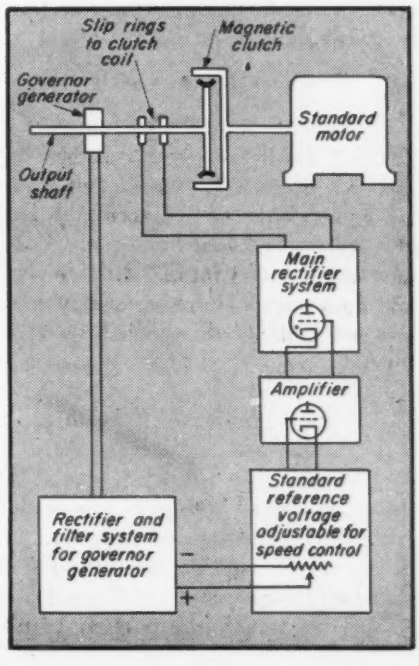


FIG. 10—Approximate loss comparisons between damper control, inlet vane control, slip ring motor and Dynamatic drive for induced draft fan

The development of the safety trip system and the automatic transfer scheme has caused more confidence in tube applications. Not only does this method detect tube failure but reflects any component part failure, since a continuous check is made on the operating results. Electronic control applications in the power plant are many fold provided they can be made reliable, as this application has proven to be.

FIG. 11—Block diagram illustrating relationship between important elements of an electronically controlled variable-speed drive



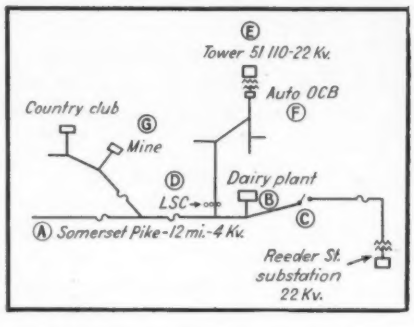
Line Shorting Contactor Betters Service to Dairy

D. R. PATTISON, *Electrical Engineer, Pennsylvania Electric Co., Johnstown*

Five years' experience matches continuity of looped or duplicate feed to rural load center—Only two lockouts in 500 operations, others automatic restoration

ONE OF the rural circuits of the Pennsylvania Electric Co. suffered numerous outages due to collisions of automobiles and trucks with poles located along the highway. The 4-kv. circuit paralleled a rural road which wound its way up through a narrow valley with resulting sharp turns and dangerous curves. Analysis of the outages on this circuit indicated that some were of a permanent nature, where the damage to the pole or wires was severe, but in many cases the faults were temporary since the conductors were merely swung together, and after the resulting arc was extinguished the circuit was in a condition to resume service.

A very satisfactory solution to the problem on this circuit was found in the arrangement shown in the accompanying schematic diagram of a portion of the circuit, which for the past five years has had extremely satisfactory service.



LONG thinly loaded rural feeder protected by line shorting contactor to improve service to dairy

Dairy Required Continuity

For many years the outlying distribution circuit (A) was fed from the Reeder Street 4-kv. substation in the metropolitan area. Most of the load served consisted of homes and farms in the rural district but a dairy processing plant at (B) was an important concentrated load, which, because of its nature, required a high type of continuous service.

The large number of faults to which this circuit was subject because of lightning, tree branches, and the aforementioned automobile collision problem required modification to improve the service, particularly to the dairy plant, and yet the revenue from the remaining portion of the circuit did not justify a material expenditure.

Since many of the outages originated from temporary faults, which would not trip the station circuit breaker, but would blow sectionalizing fuses, it was decided that the proper solution was the installation of some apparatus which would enable the circuit to be cleared of temporary faults without the blowing of sectionalizing fuses, so that service could be restored to the entire circuit whenever possible.

Line Shorting Contactor

The feed was interrupted from the normal source of supply by the open disconnect at (C) and the source was relocated at Tower 51 through an automatic reclosing oil circuit breaker at (F). At the same time, three R.&I.E. Co. Type LSC line shorting contactors were installed at (D) on the new feed line.

The line shorting contactor immediately set up a record of almost perfect uninterrupted service for the dairy plant. Through its half-cycle shorting of transient faults, both the branch and main line fuses on the line were prevented from blowing on temporary faults. The line shorting contactor, which is normally connected in series with the circuit, operates so fast that its contacts short out or bypass the arc before the fuses can blow, and, even more important, before any damage to melting type fuses can occur. Thus, when the circuit is interrupted by the reclosing circuit breaker, the temporary faults are removed from the circuit and service is restored to the entire line when the station breaker recloses.

Only Two Lockouts

On permanent faults, however, such a severe damage to a pole with wires down or hopelessly tangled, the line shorting contactor locks out after the initial tripping of the station breaker and allows the proper fuses to blow.

So excellent has been the performance of the equipment on this line during the past five years that the dairy processing plant is most enthusiastic over the continuity of service being rendered to them. It has equalled a separate loop feed into their plant, which would have been prohibitive from the economic standpoint.

During the past five years, the automatic reclosing circuit breaker at Tower 51 has shown a total of 500 operations with only two lockout operations. Peculiarly enough, these two operations have been traced to improper application of across-the-line starting motors at the mine, location (G), where the inrush current has been sufficient to operate the line shorting contactor and the circuit breaker through to lockout. Modifications in starting procedure have now eliminated this source of trouble and the former type of service is now again being given on this circuit.

Pittsburgh Sun-Telegraph Photo

The Pittsburgh Story

A Study In Public Service

GEORGE DOYING, RICHARD N. LARKIN and STANLEY TUCKER

PITTSBURGH'S four-week-long electric power strike wrote a new book about labor disputes in the electric power industry, but not every page is wholly black.

The strike against the Duquesne Light Co. and its affiliates by members of its Independent Association of employees began at 9:30 a.m., September 24. It ended a few hours less than 27 days later, as strikers voted, on October 20, to accept arbitration. Thus, it was the longest disruption of central station service in the industry's history, and the walkout was ended on precisely the terms which had been offered 46 days before the strike ended.

While complete statistics on the strike and its effects are not obtainable, it seems a reasonable assumption that the Pittsburgh strike was the most expensive in the industry's history. Probably no other strike has seen more attempted sabotage of the properties involved. None, even including last spring's strike threat against the Virginia Electric and Power Co. which was settled by drafting the employees, provoked so dramatic a legal battle as resulted from the Pittsburgh city administration's demand for an injunction against disruption of service.

City Not Ruined

Perhaps the most imposing fact about the Pittsburgh strike, however, is that it just did not begin to lay the city low as it had been widely feared such a strike would. Two significant reasons for this are: (1) a core of supervisory personnel kept one unit running in each of three generating stations and the system operator's board functioning; (2) an amount of power equal to that generated could be called on from ties to neighboring utilities and industrial plants in the area. Thus the ability to maintain essential vital service was not actually impaired.

The city was inconvenienced sorely. Many people lived up to a month on unemployment compensation checks rather than on paychecks. Residents were exhorted constantly to restrict themselves to minimum consumption of electricity. Trolley transportation was disrupted for over two weeks.

Another reservation must be asserted against attempts to translate the Pittsburgh record into a pattern of future power strikes. That is the fact that, with one known exception, the strikers never disrupted the major interconnections over which Duquesne drew capacity and energy from neighboring producers. Had these interconnections been deenergized permanently, it is generally agreed, the Pittsburgh strike would have been a very different one—probably much shorter and much more severe. The one successful attempt came through an act of sabotage.

What makes this qualification so important is that it arose from a purely local situation. The striking

union is independent of the two national labor organizations. Had it been affiliated, sympathy action by organized workers of interconnected systems would have been likely. Officials of the American Federation of Labor and the Congress of Industrial Organizations, both strong in Pittsburgh, made it plain that had the striking union been affiliated, it would have received their support.

Despite the qualifications there are some encouraging facts seemingly applicable elsewhere. In failing to be as catastrophic as it had been expected to be, the Pittsburgh strike showed that a long power strike need not wreck a city provided the company is not entirely shut down but can operate at one third capacity or better. Actually, it was less expensive than the coal and steel strikes which racked the city this year.

In assessing the inconvenience to which Pittsburghers were subjected outside their homes, it appears to be a fact that the transport tie-up, resulting from a refusal of streetcar and bus operators to cross Duquesne picket lines, caused great inconvenience and actual physical loss. In a smaller measure, the same might almost have been true of the steam heating tie-up in the downtown district, where more than 300 buildings are served by a Duquesne Light Co. affiliate.

That these are accurate assertions may be seen from the strategy developed to end the strike. When it became apparent that Duquesne Light was going to carry a substantial part of its load, the strategy involved getting the community back as close to normal, as rapidly as possible.

The Strike and How It Happened

THE STRIKE was the second called against Duquesne in 1946 by the independent union. The first was a 19½-hour strike February 12. Between the two, there were months of arbitration, negotiation and strike threats. Before the February strike there had been months of fruitless negotiation. After the September-October strike, there will be weeks of arbitration. In a word the relations between Duquesne and the independent union have been almost hopelessly snarled for at least a year. The most unfortunate aspect is that there seems little reason to believe that the air has been cleared appreciably at this time.

The latest strike was born of a strike notice filed July 30. The union submitted a list of 35 demands to be embodied in a new contract to replace that expiring August 31. These demands, estimated by the company to cost in excess of $22,000,000, include a union shop; a 20 percent raise on top of an 18-cents-per-hour raise awarded last spring; 13 holidays paid for at triple time; vastly liberalized vacation and pension plans; a triple split of company earnings over 6 percent; a welfare fund; severance and quit pay schedules; service bonuses; company-paid hospital, medical and surgical plan; and limited "travel time" pay.

After months of antagonistic negotiations, a strike was scheduled for midnight, September 10. Minutes before it was to become effective, any disruption of service by the company or union was enjoined by the Allegheny County Common Pleas Court. It based the ruling on the common law powers of the court to prevent a public calamity.

BUS DRIVERS inch through picket lines after Mueller told them power workers would cross their lines if positions were reversed

Pittsburgh Press Photo

Agrees to Arbitrate

Two days later, hours before the preliminary restraining order was returnable, Leo T. Crowley, president of a Duquesne holding company, and George L. Mueller, president of Duquesne's independent union, signed an agreement to arbitrate. Hearing on the order was postponed for twelve days, until September 24.

In the interim, Mueller renounced his agreement to arbitrate and attacked the restraining order as a "scrap of paper." Union leaders declared the strike would take place and ordered members to attend the injunction hearings September 24 after less than half of them had voted again, by a 3-1 margin, to refuse arbitration which had been offered by the company September 4.

At the hearing September 24, a preliminary injunction replaced the order. Mueller was held in contempt of court.

The next day, previously undiscernible sympathy of other labor groups flared violently. Sympathy

Pittsburgh Press Photos

SIGNERS of original arbitration pact are Leo T. Crowley, for Duquesne, Mayor Lawrence and George L. Mueller

MUELLER, later, renounced arbitration pact, called restraining order a "scrap of paper," set walkout date

strikes and public demonstrations contributed immensely to the confidence of the Duquesne strikers. Mueller apologized to the court and was freed to attend a membership meeting at which he was pledged to recommend acceptance of a new Duquesne offer made immediately after Mueller was jailed. Members of the strike committee had been pledged similarly to recommend acceptance of this offer. Both Mueller and his strike committee members told the court the offer was acceptable to them but it would have to be submitted to the membership.

Union Assails Injunction

At the September 25 membership meeting, the union voted not to consider the offer until the injunction was dissolved and Mueller freed. September 26 saw the city ask dissolution of the injunction since growing sympathy strikes and mass action constituted a graver threat to the public than did the power strike itself, particularly with Duquesne able to maintain limited service more than sufficient to meet public health and safety needs.

After dissolution of the injunction, Mueller rejected September 25 offer.

Streetcar and bus operators refused to cross Duquesne picket lines, cutting off public transportation. Coal drivers refused to break picket lines around the steam heating plant of a Duquesne affiliate serving downtown buildings.

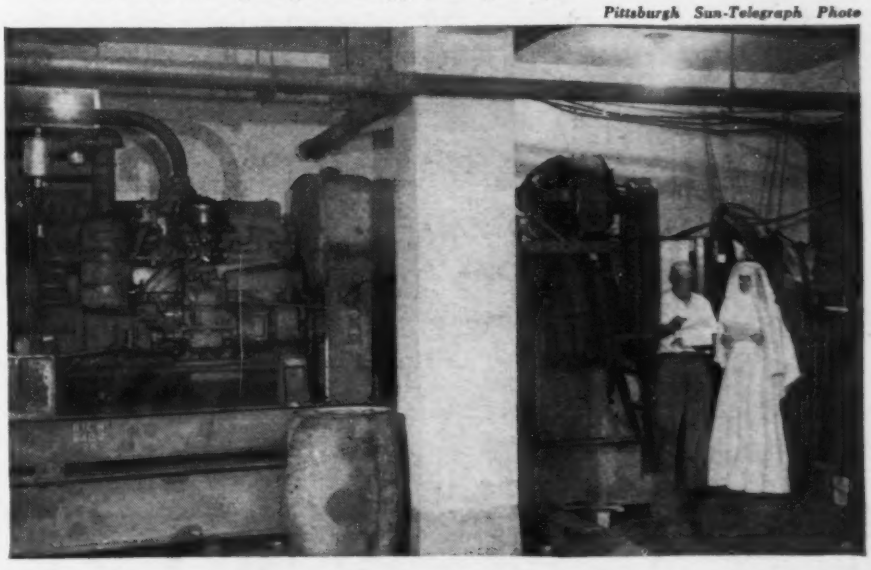
Soon appeared the first of several defections from Mueller's leadership. Substation operators formed a union of their own, then joined District 50 of the United Mine Workers, A.F.L. Department stores reopened, using power in some measure generated by themselves. Duquesne's load grew slowly, in the face of sabotage.

An NLRB election, with three other nationally affiliated unions on the ballot, was scheduled, and petitions urging arbitration were submitted to Mueller. Streetcar and bus operators returned to work. The dissident factor voted to accept arbitration. A few days later, the independent union easily won the NLRB collective bargaining election. Thereafter, steam heat was resumed as coal deliveries through picket lines began. As behind-the-scenes activity of the rump faction grew in spite of its election defeat, Mueller conferred with U. S. Labor Secretary Schwellenbach and returned to Pittsburgh with a statement implying that junking of national wage stabilization controls was imminent and that it would remove the bar to arbitration. Labor Department sources denied the implication.

On October 20, the union accepted arbitration after hearing Mueller report on his Schwellenbach conference. The next day, the walkout ended but with basic strike issues unresolved.

MERCY HOSPITAL auxiliary power generator that assured emergency service in event strike strangled power supply completely

Pittsburgh Sun-Telegraph Photo

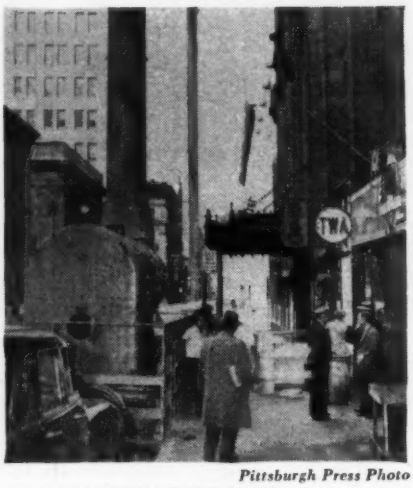


Strike-Bound System Operation

ON THE MORNING of Tuesday, September 24, the Duquesne Light Co. supervisory staff had been notified that all station and distribution operating personnel would leave their posts before 10:00 a.m. to attend a union meeting scheduled for that hour. Shortly after 8:00 a.m. the day shift began to leave Frank R. Phillips station.

At this time the Duquesne system load totaled about 370 megawatts as compared to a normal (preceding week) of 456 mw., arrangements having previously been made with certain large industrial consumers to reduce their demands in event of a strike. Of the 370 mw. output, Phillips, Reed, Brunot Island and Colfax stations were sending out about 335 mw., the remainder being imported over ties from other nearby utility companies.

Plans called for continued operation of Phillips' single 74-mw. (60-mw. nameplate) unit, one 60-mw. unit at Reed, two 40-mw. units at Colfax. The remainder of Reed's 180-mw., Colfax's 262.5-mw. and all of the older 116.5-mw. Brunot Island equipment were to remain inoperative. Thus the system capacity of 633 mw. would be reduced to 214 mw., about two-thirds in actual operation.



Pittsburgh Press Photo

HEATING BOILERS will remain to impede street traffic "just in case"

By 8:30 a.m. all operators had left Phillips, and by 9:00 a.m. the same situation obtained at Reed and Brunot Island. However, normal operation was still being carried on at Colfax where only the maintenance crew had left.

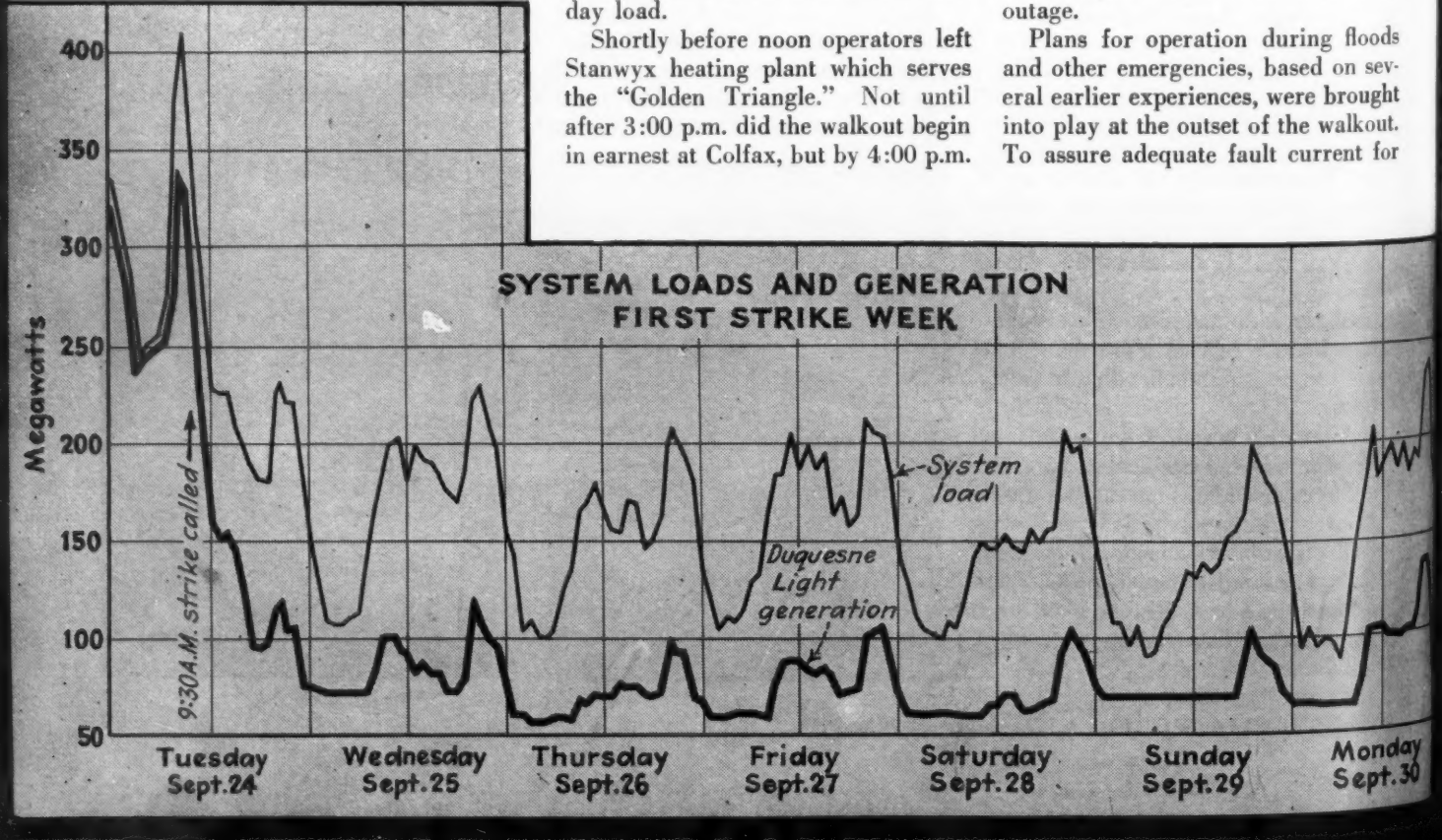
Brunot Island, in accordance with prepared plans, began to drop load at 8:35 a.m. in an orderly manner, preparatory to complete shutdown for the duration of the strike. Shutdown was complete about 9:30. By noon, load had been reduced to 225 mw., something less than half normal day load.

Shortly before noon operators left Stanwyx heating plant which serves the "Golden Triangle." Not until after 3:00 p.m. did the walkout begin in earnest at Colfax, but by 4:00 p.m. all except one 40-mw. machine were down. At this time Duquesne generated about 125 mw. of the 200-mw. output, the majority of the remainder coming from the utility ties, some from industrial plants in the district.

Radio appeals to domestic consumers, supplemented by direct contact with all large users, requested voluntary curtailment. These steps succeeded to the extent that the evening peak reached a short-time high of only 230 mw., a value not appreciably exceeded for the following two weeks. Duquesne's own share of evening peaks during the first half of the 27-day strike ranged from 100 to 150 mw., generated on three machines (plus one run primarily for wattless) by 92 supervisory staff workers in the stations aided by 13 higher echelon office personnel.

Hub of electrical operations centered at the system's downtown board into which are telemetered the output values for each station and the principal interconnecting ties with other systems. Telephone turrets afford communication with substations. Effectiveness of the telephone system was demonstrated at the time of the only serious disturbance to the system, loss of the Colfax tie with another utility when about 40,000 kw. was dumped within 27 seconds of the outage.

Plans for operation during floods and other emergencies, based on several earlier experiences, were brought into play at the outset of the walkout. To assure adequate fault current for

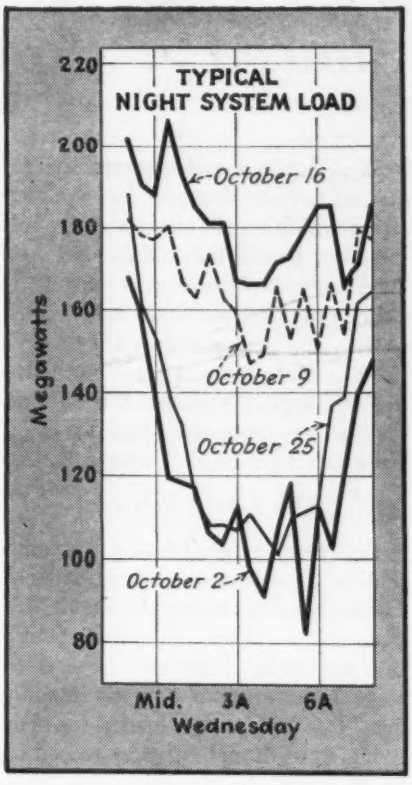


relay operation, the entire 66-kw. system was operated as a solid ring. Segments of load, operating radially from the ring, were set up so they could be individually tripped in event of system trouble. Services to hospitals and other vital needs of the community were segregated and yellow tagged for holding in under all circumstances.

Data sheets on large industrial consumers, prepared originally for use in event of war sabotage, showed values of minimum demand essential to the safety and non-operating preservation of plant facilities. These sheets were brought into play during telephone contacts with the consumer's power engineers to effect load reductions to minimum safe levels. Similar arrangements were negotiated with large commercial installations, stores and office buildings.

Smaller industrial plants were requested to curtail operations during day and evening hours but were urged and even encouraged to operate a midnight-to-morning shift during low-demand hours, and to make use of week ends, particularly Sundays, for essential needs to carry on manufacture of competitive items. Success of this transfer, insofar as night operation is concerned, is shown above.

For the 27-day period, most of the supervisory staff remained continuously at their posts, requiring provision of sleeping facilities, food and a whole variety of sundry necessities. Previous emergencies, primarily during flood season, had required provision of cots and bedding. These supplies were again brought into use and distributed to the generating station, substations and office personnel.



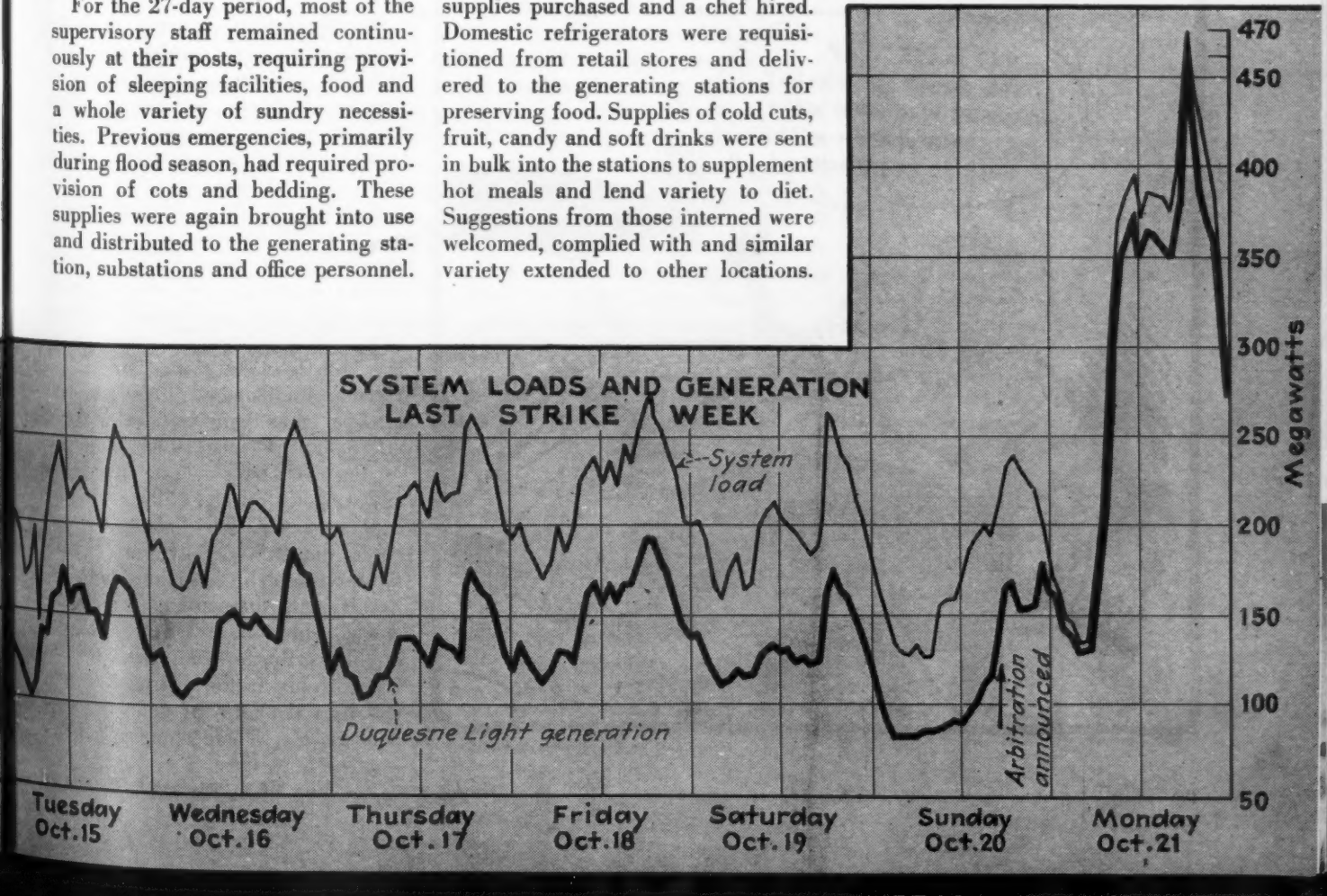
From the beginning the problem of food supply became vexing. Local supplies of hot meals were promptly picketed. Cold sandwiches and milk soon became monotonous. Even the traditional coffee palled.

Facilities of a central cafeteria at a company storeroom were extended, supplies purchased and a chef hired. Domestic refrigerators were requisitioned from retail stores and delivered to the generating stations for preserving food. Supplies of cold cuts, fruit, candy and soft drinks were sent in bulk into the stations to supplement hot meals and lend variety to diet. Suggestions from those interned were welcomed, complied with and similar variety extended to other locations. Some 33,000 hot meals were prepared and distributed, necessitating 20,000 car-miles of travel.

The "service of supply" could not stop at food. Prescriptions were filled, clothes picked up at homes, toothbrushes and shaving cream purchased, messages delivered and a wide variety of requests carried out. Not only were movies and projection equipment made available regularly, but at certain company headquarters church services were held, a magician and accordionist circulated, even a Hammond organ brought in—to relieve monotony.

Before noon of the day of the electric system walkout the operators of Stanwyx steam supply station left their posts. Supervisory personnel continued in operation for a brief period until coal bunkers, usually supplied by trucks and of small capacity, became empty, after which the distribution system could no longer be kept hot.

Several downtown office buildings and a few department stores found it possible to set up locomotive type boilers in the streets, some fired by gas, others by coal. However, about the time these were ready for steaming, the major part of the steam system was returned to operation.



Business Slowed . . . Not Stopped

PITTSBURGH'S power strike was kept from becoming ruinous largely because Duquesne could keep support of loyal supervisory employees to operate the system and draw upon interconnections for capacity and energy. As shown elsewhere, its operations ranged from about 35 to more than 50 percent of normal.

Complete statistics demonstrating the power strike's effect—or lack of it—on the business and industry of the Pittsburgh district were not available three weeks after the strike ended. In two of the three major categories which constitute the bulk of the Pittsburgh district's economic activity, available figures demonstrate that strike losses were not as heavy as had been feared and that the post-strike rebound was such as to indicate a mitigation of the effects of the tie-up. These same figures demonstrate that the coal and steel strikes which racked the district earlier this year had a demonstrably greater effect upon its economy than did the power strike. It does not necessarily follow, of course, that any future power strike which might affect a metropolitan area would follow the same pattern. Indeed, there are reasons to believe that some factors which mitigated the Pittsburgh loss may not be present some months from now. But in Pittsburgh, the power strike did not lay the economy low, just as it did not strangle normal living.

Sales Losses Recouped

Considering retail trade first, since that is the common denominator of all metropolitan areas, the Retail Merchants Association does not believe that any of its downtown department store members can demonstrate any net "loss" in sales because of the strike, even though all were closed for 13 days and the transportation tie-up extended through the first week after they reopened.

Official figures show that department store sales averaged 185 index points during the four weeks before the shutdown, only to soar to an average of 211 in the four weeks following resumption of business, including a week when transportation to the downtown area was completely dependent upon taxis or private vehicles.

Although food store sales were not charted separately, a sampling of chain stores indicated that the strike had little or no effect upon gross.

Retail and banking sources agreed that cash sales were down and charge sales up, although this is a phenomenon that antedates the power strike.

Big Steel Works On

Steel mills and a few large industrial plants having their own generating facilities were not seriously hurt. Other smaller plants managed some production. Transportation was, for the major industrials, more of a problem than power. Such industries as iron and steel production, coal, electrical equipment manufacturing and glass continued practically without interruption. Steel ingot output in Pittsburgh remained above the national average for the entire power strike.

Smaller industrials, particularly including those plants which treat and fabricate steel rather than produce it, were hard hit, with estimates indicating that as many as 400 such plants were partially or completely shut down. A U.S.W.-C.I.O. source estimated that 80,000 district steelworkers, most of them employed in the smaller plants, were idled for the strike's duration. The figure seems somewhat high, particularly in view of a United States Employment Service bulletin setting the number of Pittsburgh unemployed, obviously including more than just steelworkers, at 75,000. To the extent that the smaller steel plants operate outside the city and within the Pittsburgh district, however, the discrepancy between the U.S.W.-C.I.O. and USES figures would be minimized.

Obviously, the manufacturing shutdowns which were effected will be doubly costly, for their effect will be felt not only in the district but elsewhere in the form of deferred components, etc. These stoppages, how-

HIS PRAYER OF GRATITUDE
AND BLESS THAT LITTLE GROUP OF TIRELESS WORKERS WHO HAVE KEPT ME GOING WHEN I NEEDED HELP SO DESPERATELY
PA PITT
NEWS
FOREMEN AND SUPERVISORS WORK NIGHT AND DAY TO SUPPLY POWER DURING STRIKE —
HUNGERFORD

Hungerford in The Pittsburgh Post-Gazette

ever, were minimized during the latter stages of the strike, when Duquesne advised the use of energy for manufacturing between midnight and dawn. Duquesne's hourly load curves for the strike show that the normal night-time valley in energy consumption was filled in by more than half.

Originating carloads for the district declined from 194.3 index points in the last week before the strike to 182.3 in the second week of the strike, rising to 185.4 during the last full week of the strike and soaring to 200.7 in the second week following the strike. However much or little this might apply to a power strike in another metropolitan area, it does not signify strangulation of the Pittsburgh district's industry, even though the components which go into the total represent a greater area than that affected by the strike.

Total production, which stood at 191 index points in the last week before the strike, slumped to 169 for the third strike week, rising again to 185.4 in the second week after the strike. Electric power production, a figure which includes that of the West Penn system, went from 193.1 points in the last week before the strike to 128.9 during the second week of the strike, then rose steadily to 139.8 during the final strike week, and to 200.1 in the third week after the strike. On November 12, during the fourth week after the strike, both Duquesne and West Penn recorded record high peak loads, a circumstance which might indicate that some of the strike loss is now being made up.

Estimates as to the total number of people made jobless temporarily by the power strike run between 100,000 and 125,000, based on United States Employment Service statistics.

Between 47,000 and 50,000 persons drew one or more unemployment compensation checks, with only a few receiving as many as three checks. Total payments were estimated at something less than $2,000,000. Claimants and payments as a result of the power strike were under corresponding totals for the steel strike last winter.

Between September 30 and November 2, the Pittsburgh USES office alone handled 201,160 applications for unemployment compensation, an average of about 7,000 daily. Normally, average daily applications total less than 5,000.

None of the power strikers received compensation since they did not complete the mandatory five-week waiting period. About 3,500 transit workers, idled because of operators' refusal to cross a picket line, were ruled ineligible for benefits short of the five-week waiting period.

The Public Didn't Care

IN VIEW of the near-hysteria which arises with any real threat of a metropolitan power strike, the weirdest attribute of Pittsburgh's walkout was the public apathy toward it after it became a fact.

One contributor to the public apathy was the magnificent job Duquesne performed through the loyalty and competence of a small group of employees dedicated to public service. Lights did stay on in homes. Refrigeration was provided, water was pumped, streets were lighted except where lamp maintenance failed.

Leaders Deplore Lethargy

Everywhere in Pittsburgh there may be found civic leaders, men and women in public and private life, who bemoan the failure of the public to "get mad and do something about this awful strike." One attributed the lack of feeling to the fact that some strike-bound employees continued to be paid, even though they did not work. Another cited the Unemployment Compensation checks as a species of municipal soothing syrup, however small the dose. Some thought the rash of earlier strikes in the city's major industries had dulled community reaction to a state of lethargy. Some argued that the unaffected operation of basic steel plants and coal mines, both large-scale employers of labor, cut down the number of malcontents to a point at which only apathy could have been expected. One professional booster even argued that there was no public apathy apparent.

Whatever may be the merits of these explanations, it remains true that more than 35,000 people flocked to a professional football game on the afternoon that a few hundred straggled into a public mass meeting to protest the strike.

Public Ownership No Answer

One of the most obvious and readily promoted panaceas for Pittsburgh's power strikes has barely been mentioned throughout the past year of Duquesne-union controversy. That would be public ownership, of course.

The question of public ownership of the Duquesne system has been completely out of the picture. There can hardly be better demonstration of the absence of public ownership sentiment than the assertion by County Commissioner John Kane that if he had to win support for public ownership of the property, he would not know where to go in Allegheny County to find it. Kane, a political leader of real stature, and a long-time power in organized labor, spearheaded the only real public ownership move the county has witnessed in a decade. He and other officials still believe in public ownership, but they admit that it has not yet been as much as a trivial issue. Letters to newspapers and some to the mayor were the best that public ownership supporters mustered in the Pittsburgh power dispute.

Pittsburgh's Problem . . . George L. Mueller

Pittsburgh Sun-Telegraph Photo

JUBILANT FOLLOWERS mob Mueller after his release from jail. Four weeks later Pittsburgh in sober mood finds him more problem than celebrity

ANOTHER FACTOR which makes the Pittsburgh experience less than precisely applicable to future labor disputes threatening strikes against electric utilities is President George Mueller of the Duquesne union.

Pittsburgh agrees on one point regarding its year of power strikes and strike threats—that Mueller is the cause of a large part of the trouble. This assertion may be heard as readily from laboring people as from corporation presidents. He has been attacked vigorously by city newspapers and by Pittsburgh's pro-labor mayor. Company officials plead absolute inability to do business with him. Both A.F.L. and C.I.O. national unions have attempted to take over the independent. One labor leader predicted that Mueller would be ousted when the present arbitration settlement has been completed and invoked. Everywhere, people discuss the possibility of deposing him as president of the union.

A Vote for Independence

Yet his union won an NLRB election, held after three weeks of strike-bound discontent. This was regarded by important public officials as a vote for independence, even at the cost of keeping Mueller. Pittsburgh newspapers, within 48 hours, carried photographs of Mueller being led away to serve a one-year jail sentence for contempt of court and of Mueller being carried to union headquarters on the shoulders of a jubilant throng.

Intensive Publicity Buildup

City and county officials charge—and newspapermen admit—that the intensive and unrestrained coverage accorded Mueller as a person during the long negotiation preceding the strike had the effect of building him up in his own mind as a public figure of great power. One of the commonest remarks in Pittsburgh during the last two months has been that Mueller became infused with a sense of self-importance.

Yet, no estimate of Mueller can overlook his 16 years' study at Carnegie Tech's night school, for an electrical engineering degree. Through the best part of a decade, Mueller led the union to repeated victories against national labor unions which have striven continually to take over the independent. Such victories, and the continued existence of an independent union in such an organized labor stronghold as Pittsburgh and Allegheny County, are indicative of ability, however used.

Recalls Arbitration Pledge

On September 12 Mueller signed an agreement of arbitration; yet a 27-day strike ensued before arbitration was finally accepted.

Testifying in court, under oath, Mueller conceded that he had attacked the restraining order as a "scrap of paper," despite the fact that it was due legal process.

Mueller told reporters that the settlement offer by Leo Crowley had been rejected by the union membership. Minutes later, he told them the Pittsburgh papers had carried "fair" accounts of that particular union meeting. The papers reported that the offer had not been voted upon.

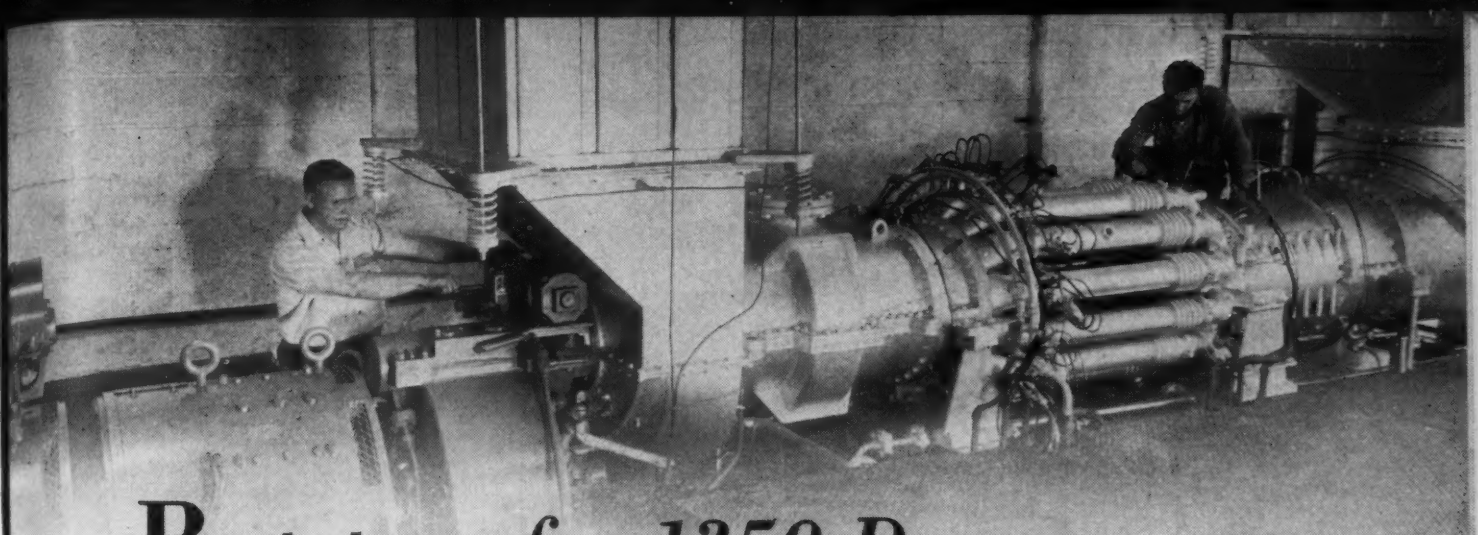
He argued repeatedly that the union got nothing from arbitration, even though the spring arbitration contained an across-the-board pay raise of 18 cents. He cultivated the impression that national wage stabilization policy would disallow any pay raises, although such policy applied only where a price increase results from such wage increase. Duquesne accepted and paid the 18-cent award even though, in seven of nine bargaining units, it was 2 to 13 cents above that allowable under wage stabilization had a rate increase been sought.

Mueller told reporters that no energy entered the Duquesne system through its West Penn interconnections because West Penn's Springdale unit was down, as it was. Any electrical engineer who ever saw a map of existing transmission lines would have known this to be ridiculous.

Denies Approving Offer

Mueller denied he had told anyone that the September 25 offer was acceptable. Yet Anne X. Alpern, city solicitor and an officer of the court, asserted in court that Mueller had declared the offer acceptable.

In Pittsburgh's discussion of the strike, the overwhelming refrain is "Mueller, Mueller, Mueller." Perhaps it is overdrawn, as imprecisely informed discussion often is. Overdrawn or not, it is as prevalent in anti-company circles as it is in pro-company circles, and as readily available from organized labor leaders as from corporation officials. The anti-Mueller talk which is rife in Pittsburgh can be found at many levels, not just those which are normally anti-labor but even in the ranks of labor, where Mueller still rates as Pittsburgh's problem child.



Prototype for 1350 Degree GAS TURBINES

THOMAS J. PUTZ, *Manager, Gas & Locomotive Turbine Section, Westinghouse Electric Corp.*

Experimental unit of 2,000 hp. now on test will afford high-temperature operating experience on major components of compact, light-weight machine of simple open-cycle type with multiple combustion chambers

WITH 80-KW. cranking power, the Westinghouse experimental gas-turbine generator set can be brought from standstill to operating speed in one minute; with 50 kw. the time is increased to one and one-half minutes. This feature, combined with light weight, small space requirement, extreme simplicity and inherent low maintenance, offers interesting possibilities for utility standby and peak service, portable power units, locomotive and marine applications.

On the drawing boards since 1943, the unit has been designed for a top temperature of 1,350 F., considered the maximum without resort to cooling, with the simplest type of open cycle to obtain actual operating experience most quickly, and to burn bunker C oil, lowest cost liquid fuel. Expected thermal efficiency at full load is 20 percent.

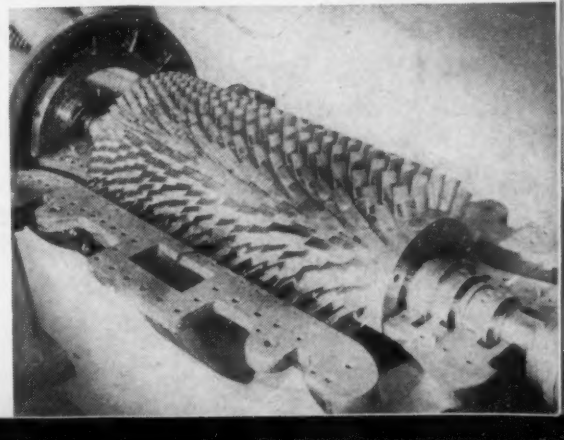
In the 20 stages of nonsymmetric compressor blading nearly all the pressure rise occurs in the rotating blades. These have a constant tip diameter of 18⅜ in. and vary in height from 3 in. at the inlet to 1½ in. at the discharge. Forged of 12 percent chromium steel similar to that used for steam turbines, blades are unshrouded and profiled at the tip. The serrated root fastening is machined in the base by a formed milling cutter, then caulked into grooves in the rotor.

Stationary blades, precision cast of 18-8 stainless steel, are caulked into grooves in the cylinder wall. They are also unshrouded and profiled at the tip.

The rotor is made from a solid carbon-steel forging and the cylinder of welded plate. All air seals at each end of the compressor are of the labyrinth type. The compressor, solidly connected to the turbine, has the greater part of its thrust balanced, eliminating need of a dummy. Remaining small unbalance is taken by a standard segmental-shoe bearing located at the discharge end of the compressor. Journal bearings are pressure-lubricated sleeve type.

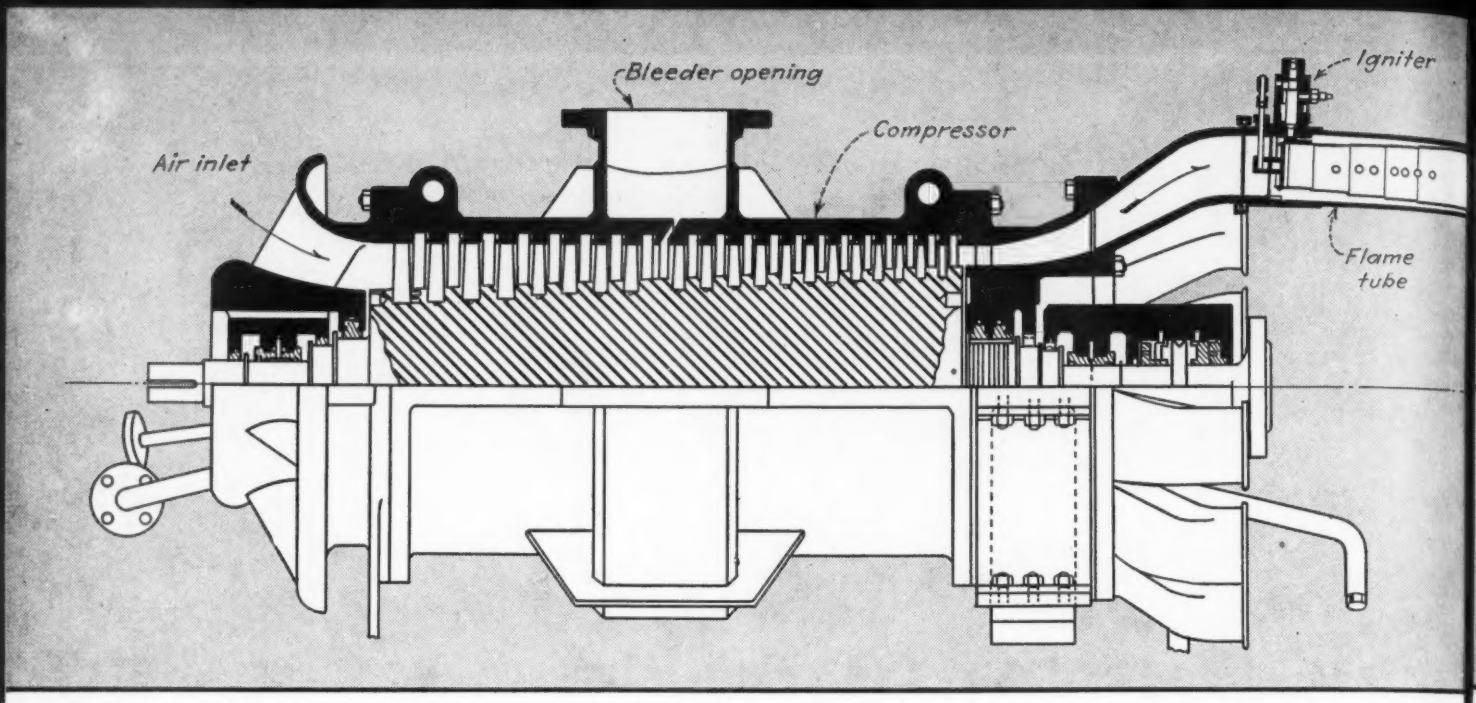
For test purposes a bleed connection has been provided after the eighth stage. Tests have proved this opening unnecessary and it will not be included in future units. Leaving the compressor, air passes through a welded-steel-castings diffuser where velocity is reduced and transition is made from an annular passage to twelve circular passages.

Maximum compressor speed of 9,200-rpm. corresponds to a 5:1 compression ratio. Reduced load requires lower pressure ratio down to



AXIAL-FLOW COMPRESSOR handles 25,000 cfm. at 5:1 pressure ratio in 20 stages. Blades are forged of 12 percent chromium steel, like those of steam turbines

*Condensed from "2000-Horsepower Gas Turbine Generator Set" presented at annual meeting of American Society of Mechanical Engineers, New York, Dec. 2-6, 1946.



2:1 which is effected by reducing compressor speed.

Twelve 4½-in. by 3-ft. carbon-steel combustor cells have bellows expansion joints welded to one end. Circular sections of chromium-nickel alloy sheet alternately corrugated, are spot welded to form the internal flame tube. Corrugations provide side wall cooling of flame tube effectively.

Air-atomizing fuel nozzles maintain high burner efficiency over a wide load range up to a heat release of 1.2 million Btu. per hr. per cu. ft. per atmosphere. After ignition is once accomplished by a spark-plug and acetylene igniter, the flame is self piloting, that is, a flow reversal of part of the air in a primary combustion zone within the flame tube maintains a hot zone at all loads. Rows of axial holes in the flame tube allow colder air to penetrate to the center of the flame tube and give satisfactory temperature distribution at the discharge.

The gas turbine itself, developing 6,000 hp., consists of eight stages designed for equal heat drop over the stationary and rotating blades at mean diameter. Like the compressor, the turbine has labyrinth shaft seals and pressure-lubricated sleeve bearings.

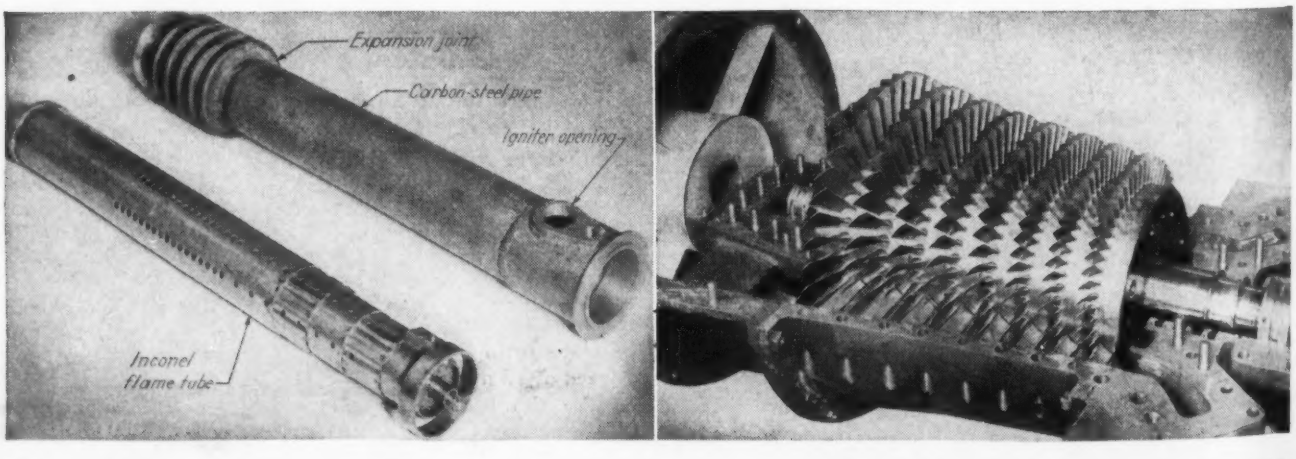
Precision-cast cobalt-chromium-tungsten blading is tapered and twisted with serrated roots finished by a form grinder dressed with a crusher wheel. Stationary blades, also tapered and twisted, have a "T" fastening machine with a carbide tool. All blading is unshrouded and profiled at the tip.

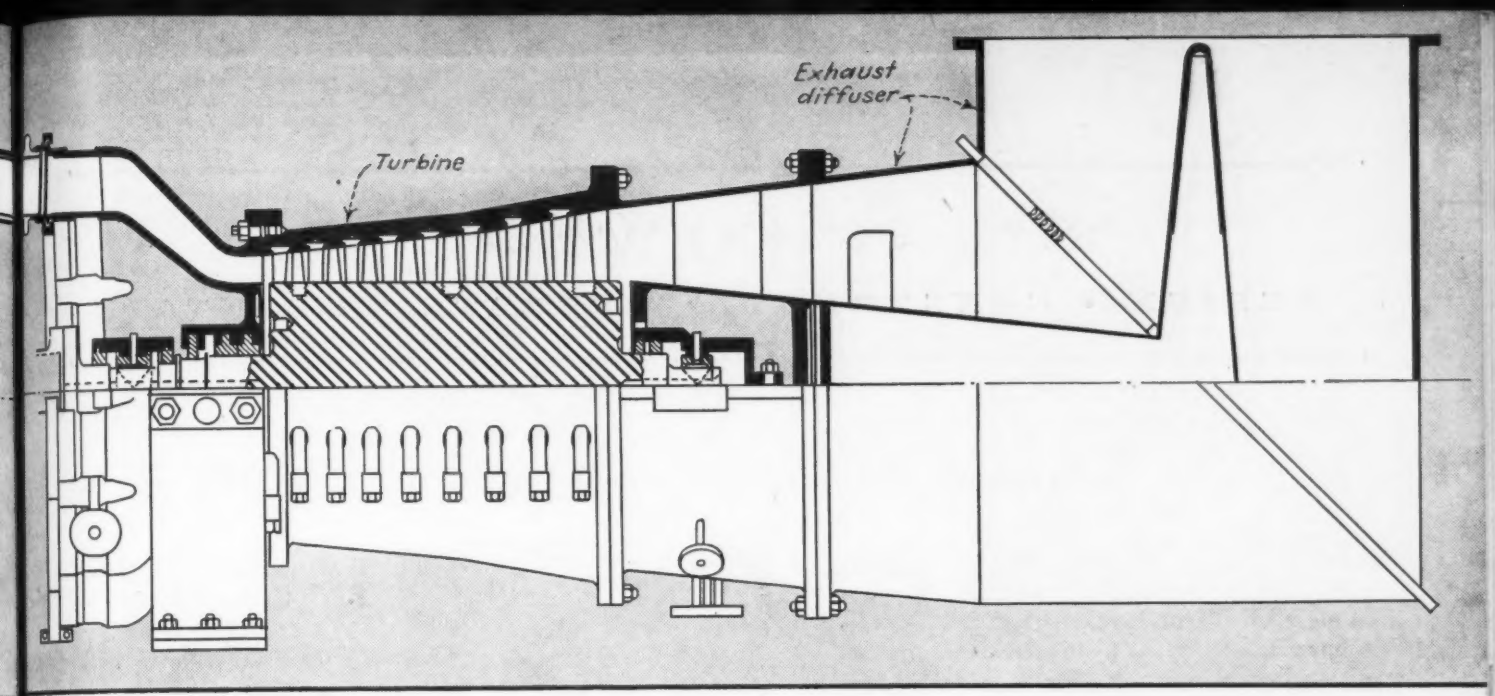
The rotor is machined from the largest forging ever made up to that time of 19-9 stainless steel, the main section being 14½ in. in diameter by 24 in. long. The cylinder, as nearly symmetrical as possible, is formed from 19-9 steel castings into which are cut grooves for the stationary blading. Horizontal flanges have been eliminated and the inlet flanges have been slotted to minimize thermal distortion of the cylinder walls.

The difficult turbine bolting problem involved by rapid temperature changes from 700 F. to 1,350 F in going from no load to full load has been satisfactorily solved by using sleeves to eliminate need of a flange and increase effective bolt length. Bolt material is Westinghouse K-42-B.

Suitable mechanical hinges allow the turbine to expand during thermal changes while still maintaining alignment with the other elements. The turbine exhausts to a diffuser and elbow designed to recover a substantial portion of the energy represented by

TWELVE 4½-in. dia., 3-ft. combustors (left) burn 1.2 million Btu. per cu. ft. per hr. per atmosphere of bunker C oil in carbon-steel pipe with Inconel flame tube. Precision-cast blades of cobalt-chromium-tungsten alloy (right) are assembled on a solid-forged 19-9 stainless-steel rotor 24-in. long





COMPLETE ASSEMBLY including generator measures 26 ft. long, 3½ ft. wide and 6 ft. high. Straight-line arrangement of components saves piping, space, weight, and keeps pressure drop to a minimum. Total weight 38,000 lb. or 19 lb. per hp. including accessories; space occupancy ¼ cu. ft. per hp.

the exhaust velocity of approximately 500 fps.

The single-reduction double-helical gear employs a 20-tooth pinion of alloy steel with teeth hobbed, flame hardened and ground similar to that used on the Pennsylvania Railroad geared-turbine locomotive already successful in actual road service. Experience with this gear design points the way to carrying twice the load without appreciable change in weight or size. The gear has pressure-lubricated sleeve bearings throughout.

Mounted on the reduction gear is a ½-hp. turning gear motor driving through a worm and wheel to a spur pinion which in turn drives the gear on the main pinion shaft. Turning during shutdown avoids thermal distortion and enables quick starting.

A double-armature d.c. generator, operating at 1,200 rpm., absorbs the useful power over a wide operating range, offering excellent means for testing and developing proper controls. This generator is also arranged for motorizing during starting.

First operated in August, 1946, the unit is destined for an extensive test program. After 50 hours of operation and more than 75 starts, it appears that the set will meet expected performance. Mechanically, the machinery runs well and has quick-starting and load-response characteristics.

During early test runs oil leakage was experienced from the compressor and turbine bearings; so the unit was dismantled and corrections made. It was also observed that firebrick in the inlet silencer was disintegrating and passing through the machine.

Because of the location in a segregated portion of the South Philadelphia shop near other manufacturing facilities, silencers were installed on both inlet and exhaust. The inlet silencer has twelve openings, the exhaust silencer 16, lined with sound firebrick. After difficulty with the brick, the inlet silencer was removed and tests made with and without inlet duct in place. It was found that the noise level in the room was unchanged with the duct in place with or without the sound absorbing firebrick. However, the noise in the stack was greatly reduced with the brick in place. The inlet silencer was then rebuilt using a brick treated in sodium-silicate solution.

While operating on a stormy day, the sodium silicate dissolved in rain water and went through the unit, depositing on the compressor blades, ruining their shape and making operation impossible. Except for the time lost in dismantling the compressor no damage was done, as the sodium-silicate was readily washed off the blading. Sound absorbing material is now being added to the exterior surfaces of the ducts to see what effect will be produced on the noise level in the room.

Possible applications for a simple open-cycle gas turbine are numerous. Its light weight, small space, extreme simplicity and inherent low maintenance will become important considerations in selecting prime movers of the future.

For locomotive application it can be built in large powers within a single cab. Advantages of no cooling water requirement are obvious. Two of the sets detailed here, for example, can be mounted side by side in a standard cab. If desirable, four sets totaling 8,000 hp. can be grouped within a cab not longer than present-day diesel locomotives.

For marine auxiliary application the simple open-cycle gas turbine can find a most useful position as a standby power unit and as a power booster. For main drive units of larger size, gas turbines will undoubtedly include regenerators and intercoolers to raise thermal efficiency.

In the central station field, the simple open-cycle unit lends itself readily to standby peak service as reinforcing capacity at far ends of transmission lines. Expense of banked boilers and spinning reserves required of many steam plants can be considerably reduced by substitution of low-cost quick-starting power sets, strategically located to supply peak loads at the most convenient point of the transmission system.

In the industrial field, gas turbines have already found a place where pressurized air is required, with power as a byproduct. In addition to this, many other suitable applications present themselves such as portable power sets for gas fields, power units for gas transmission lines and for plants advantageously located near raw material supplies.

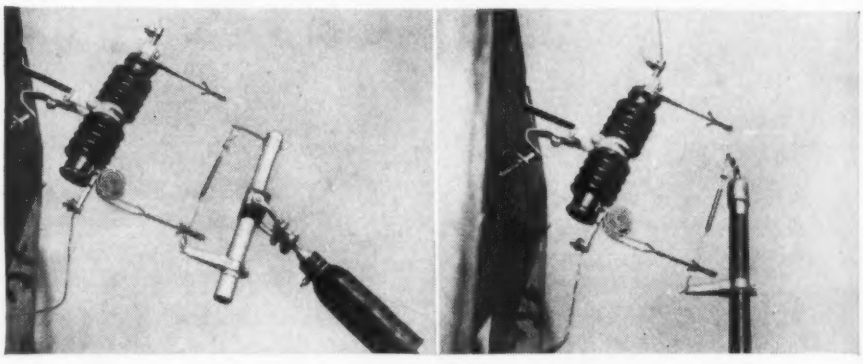
HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Tool for Replacing Trip-O-Link Fuses

DIFFICULTY of replacing Trip-O-Link fuses during windy weather and at night led Wayne Brock, of Pacific Gas and Electric Co., to suggest use of the device illustrated. It consists simply of a piece of round lacquered wood with a rod at one end and a Kearney fuse stick adapter at the other. Since the fuse link when hung on the rod is held taut by spring action of the adapter, the fuse link cannot dangle around in the wind and may be easily installed in the spring and rod retainers of the cutout bracket.

The stick of the adapter is then clasped with the safety fuse changer hot stick shown. The swivel bakelite clasping jaws of this tool make possible holding the fuse replacing device at exactly the right angle for easy replacement of the fuse, no matter where the fuse holder bracket is mounted or in what position the lineman is to work at best advantage.



TRIP-O-LINK FUSE replacing device holds fuse link taut for easy placement in fuse holder . . . VIEW AT RIGHT shows manufacturer's recommended practice for replacing fuses using a conventional switch hook

Use of this fuse replacing device is considered an improvement on the manufacturer's suggested practice of mounting his fuse stick adapter on the handle of a switch hook, as shown in one of the illustrations, because when replacing a fuse in this manner it may be inconvenient or impossible to hold the switch hook at the one and only exact angle necessary for insertion of the fuse link in its holders on the cutout bracket.

• • •

Mobilizing Circuit Data in the Field

RECENT EXPERIENCE in severe storms led Boston Edison's engineering department to prepare ten emergency survey kits to aid restoration of distribution system service by quickly putting accurate data into the hands of transmission and distribution department personnel in times of need. Each kit is a fiber container about 24 x 13 x 8 in., labeled on the outside for a specific area. Areas are determined by communities or portions of these covered from the company's

EMERGENCY KIT developed by Boston Edison's engineering department to speed circuit restoration by transmission and distribution department forces in emergencies, by concentrating up-to-date information by fast delivery to service centers to cover line layouts and locations

five main T. & D. service centers and five auxiliary service centers. Edison commercial circuit numbers are listed on the inside cover.

Each kit contains two sets of circuit maps in agreement with the circuit numbers as listed; a conventional 9 x 12-in. clip board for a writing rest; sharpened colored pencils for marking the circuit prints; ordinary pencils and pads of paper; 3 x 5-in. file cards for reference notations; street maps of the local areas, in some cases including a number of towns; and telephone numbers of the respective service or auxiliary service centers concerned. Maintenance on the kits calls for substitution of revised circuit maps as issued from time to time to insure up-to-date information.

The engineering department maintains the kits at Boston headquarters, ready at all times for spot delivery to the company's general service buildings on Massachusetts Ave. in case of emergency. In such event, an engineering department supervisor familiar with the area to which he is sent will be dispatched to area service center headquarters as needed and will be responsible for the functioning of other engineering department personnel working out of those locations. At the same time, engineering survey men, as assigned, will pick up their transportation and emergency kits at the service buildings and report at once to the service centers. The car driver for each circuit survey man has, as far as possible, a good knowledge of the area and local streets in which the survey man will function.

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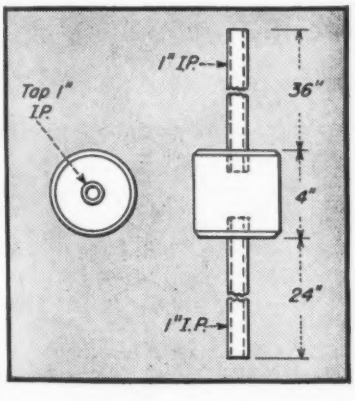
A Ground Rod Driver Designed for Safety

GEORGE A. WOLFER
The Ohio Public Service Co., Alliance

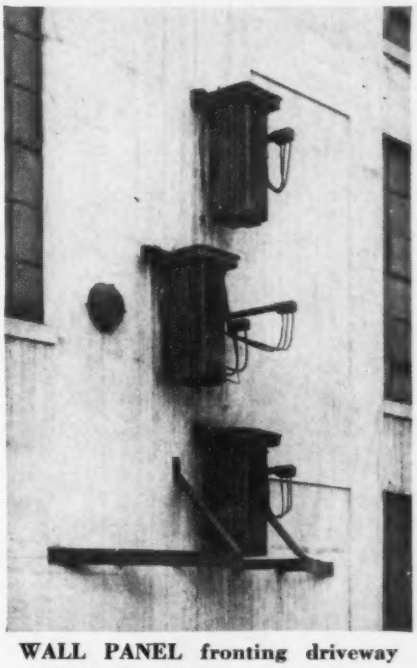


ELIMINATION of a common hazard in driving ground rods is provided with the tool illustrated in the accompanying sketch. One-inch iron pipe is used for the upper and lower sections of the driver, 24 in. and 36 in. long. A 4-in. diameter steel bar 4-in. long, weighing approximately 12 lb., is tapped and joined to the two pipe sections to assist in the driving.

The long end of the driving tool is placed over the ground rod, and up and down strokes used until the projecting part of the rod is fairly short. The driver is then turned over and driving continued to the last 2 ft., which is finished with a sledge hammer.

Platformless Mount for Lighting Transformers

AT THE PRINTING PLANT of the Case, Lockwood & Brainard Co., Hartford, Conn., three 50-kva. lighting transformers have been mounted outdoors on the building wall with no platform and a minimum of material, excellent ventilation and good accessibility, by using standard steel hangers built into the structure for support. Each transformer is used to connect a 3-wire, 3-phase, 220-volt power feeder to 3-wire, 220/110-volt secondary interior lighting circuits. The hangers are bolted through the wall by 1-in. x 24-in. rods, threaded at the end. The lower transformer is guarded by an angle-iron frame of simple design against accidental contact from below. To facilitate handling the transformers in case of replacement or temporary removal, an 8-in. I-beam weighing 18.4 lb. per foot, and 5 ft. 6 in. long over-all (with 4 ft. 6 in. outside length) was installed above the group.



WALL PANEL fronting driveway utilized for lighting transformer mounts to save space indoors and provide outside ventilation

• • •

Scheduling Periodic Primary Circuit Tests

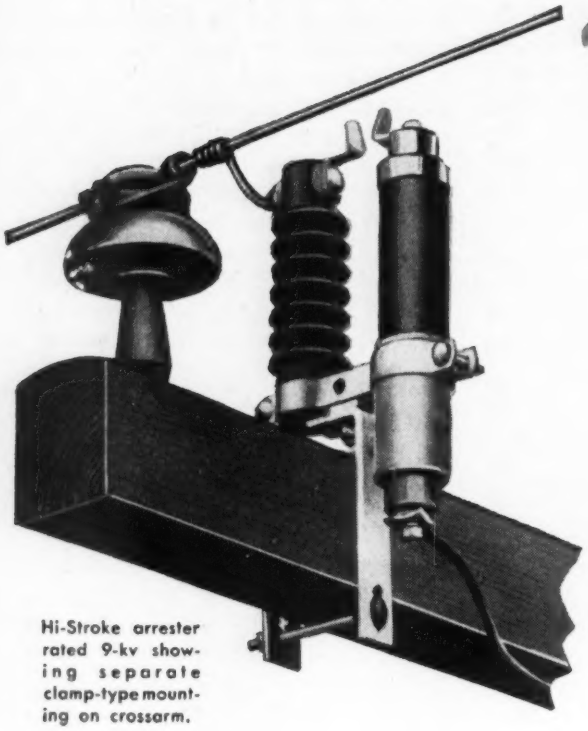
ON THE DISTRIBUTION SYSTEM of an eastern power company a complete set of ampere and voltage tests is made on every 3-phase primary circuit at least every four years (more often if load conditions require), and at peak load times. Maintenance electricians or meter department men do this work.

Certain circuits having day and evening peaks may require corresponding tests, checkups at maximum peak or at the time of expected maximum unbalance. Work is scheduled so that one-fourth of the circuits requiring daytime tests and one-fourth of those needing evening tests shall be attended to each year. This work is done between November 1 and January 1 annually.

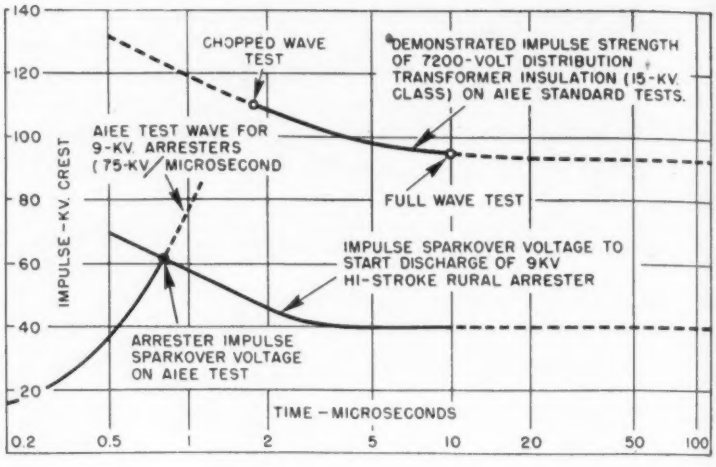
The company maintains in its file data on standard ampere and voltage conditions to be adhered to on the system. If unsatisfactory conditions appear, the maintenance engineer is notified and plans at once for neces-

New HI-STROKE

A HEAVY-DUTY EXPULSION-TYPE



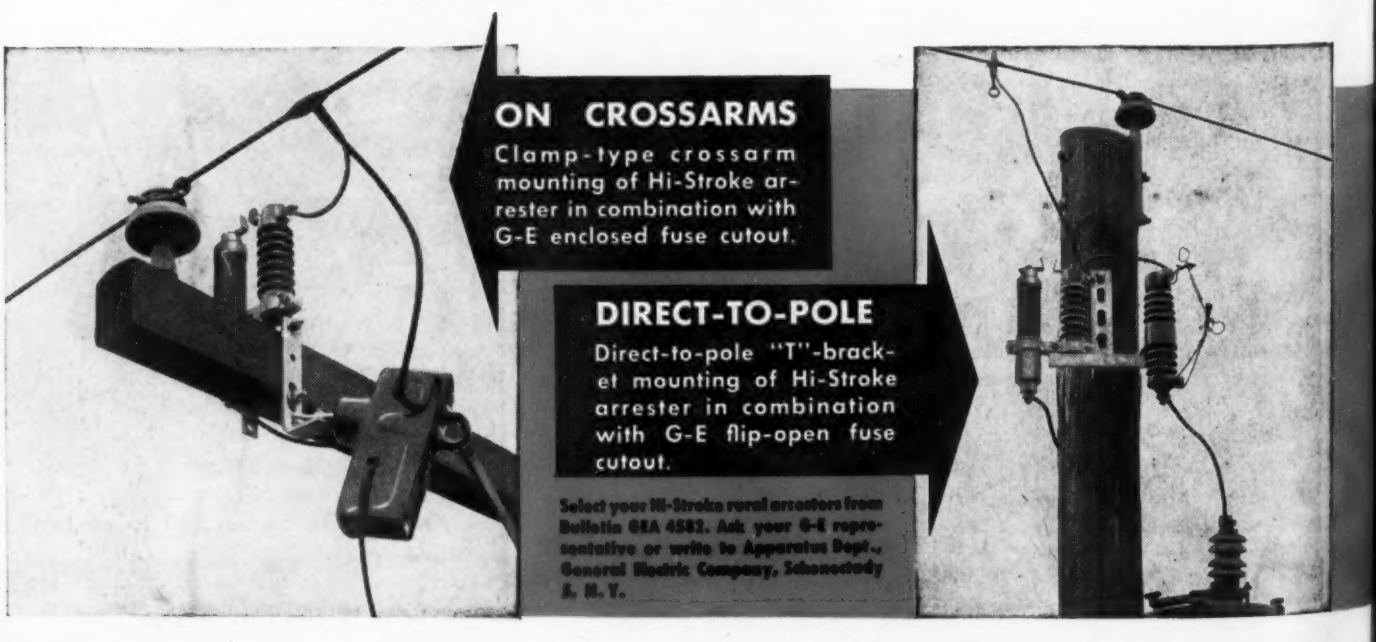
Hi-Stroke arrester rated 9-kv showing separate clamp-type mounting on crossarm.



Impulse volt-time curves showing protection level of 9-kv Hi-Stroke arrester compared to AIEE and ASA standard test levels of 7200-volt distribution transformers. A similar large margin of protection is provided by 6-kv arrester protecting 4800-volt transformers.

for separate mounting on crossarm

...for combination mountings with enclosed or open-type fuse cutouts



ON CROSSARMS

Clamp-type crossarm mounting of Hi-Stroke arrester in combination with G-E enclosed fuse cutout.

DIRECT-TO-POLE

Direct-to-pole "T"-bracket mounting of Hi-Stroke arrester in combination with G-E flip-open fuse cutout.

Select your Hi-Stroke rural arresters from Bulletin GEA 4582. Ask your G-E representative or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

RURAL ARRESTER

DISTRIBUTION ARRESTER

...WITH PERFORMANCE EFFICIENCY HERETOFORE UNAVAILABLE IN EXPULSION ARRESTERS

DESIGNED ESPECIALLY FOR RURAL SYSTEMS

6-kv rating for 4800-volt circuits
9-kv rating for 7200, 7200/12470, and 7620/13200 volt grd Y circuits

EXCELLENT SERVICE OPERATING RECORD ALREADY PROVED

by extensive installations of Hi-Stroke arresters, mounted on Type HBA rural transformers, and mounted separately, on typical rural systems since 1944.

A new G-E development with many exclusive features:

Low Impulse Sparkover—Unexcelled in Expulsion-Type Arrester Field — Has an impulse sparkover level which corresponds closely to that of efficient valve-type arresters; hence provides a large margin of protection to either *new* or *old* transformers, and prevents flashovers and minimizes fuse blowing. The electrodes of the internal gap are fixed, maintaining a permanent gap length, and therefore a consistently low impulse sparkover voltage for individual discharges or for rapidly recurring multiple-stroke discharges.

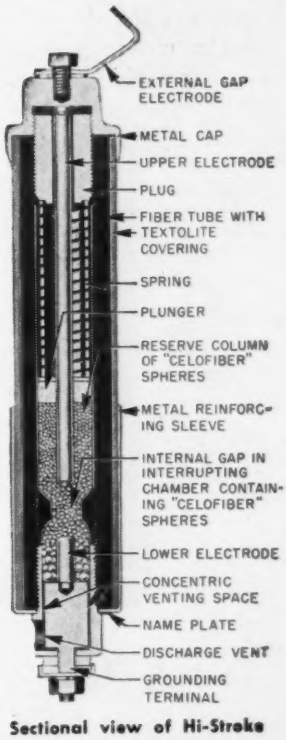
Counteracts Erosion — For Increased Arrester Life—The Hi-Stroke arrester is the *only* expulsion arrester which possesses a reserve supply of gas-evolving material in the arc path. In this unique construction a reservoir of celofiber spheres, under spring pressure, maintains a full complement of spheres between the internal gap electrodes in the arc-interrupting chamber and automatically compensates for erosion during discharge.

Negligible Arc Flame During Expulsion Action—Because of the very intimate contact of the arc with the gas-evolving material (celofiber spheres), the arc-extinguishing action is most effective and the arc flame attending expulsion action is practically negligible.

No Leakage Current Through Arrester Element—The line terminal and line side of the external series gap are supported by a liberally designed post insulator clamped adjacent to, *not on*, the arrester tube element. Hence any leakage current permitted by the insulator cannot pass through the arrester element, assuring that no voltage is applied to the arrester element except during actual discharge.

Cannot Cause Line Lockouts—External series air gap, plainly visible, indicates line not grounded. Even in event of failure of arrester element, line lead remains supported to post insulator and cannot dangle or come in contact with conductors, crossarm, pole, or grounded objects.

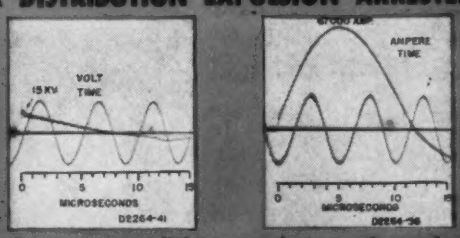
Exceptionally Small Size—Easy to Install with Various Mountings—The arrester construction is strong, compact, and durable throughout and permits choice of hangers for crossarm mounting or pole-mounting,—either separately or in combination with enclosed- or open-type distribution fuse cutouts.



Sectional view of Hi-Stroke rural arrester element.

HI-STROKE ARRESTERS MEET ALL AIEE AND NEMA STANDARD TEST REQUIREMENTS FOR DISTRIBUTION EXPULSION ARRESTERS

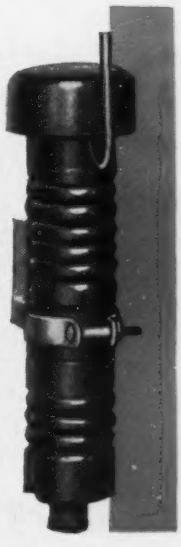
The Hi-Stroke rural arrester, with its 1200-ampere (rms), 60-cycle, current-interrupting rating, is capable of repeated operations interrupting even the full offset (asymmetrical) 2800-ampere, crest, short-circuit current.



Hi-Stroke arresters can handle the severe lightning-stroke currents on badly exposed rural lines, and readily withstand the AIEE and NEMA standard design test of 65,000 amp. (5 x 10ms) discharge current. (See above oscillograms.)

GENERAL ELECTRIC

G-E also offers the PELLET ARRESTER — a valve-type distribution arrester applicable to urban or rural systems—having outstanding impulse protective characteristics and the new N_2-filled gap chamber. Because its operation and life are completely independent of system short-circuit currents, and because it has no exposed live parts, the PELLET ARRESTER is ideally suited for applications on urban systems.



sary circuit rearrangements. These are followed by a second set of voltage and ampere tests.

All ampere tests are recorded with phase balance readings. Voltage tests are separately recorded and filed with phase balance records for each circuit. Ampere and voltage tests on a particular circuit are made on the same day as far as available instruments allow.

Tests on circuits having peak loads during working hours are ordinarily made with indicating instruments, but graphic or time-lagged maximum indicating instruments may be employed if needed. Tests on circuits with peak loads outside working hours are tested with graphic instruments or time-lagged maximum reading ammeters, installed and removed during working hours. These are normally left in circuit a full day, but are reinstalled later if needed.

Ampere tests are made on all three wires of a circuit at the substation on the load side of regulators; on all three wires of each of the principal 3-phase branches, and on one wire of each important single-phase branch. Tests over the lead sheath of cables are avoided as far as possible. Tests with indicating instruments are made as rapidly as possible, using one or more men as required. If the load balance is satisfactory to the maintenance supervisor as shown at the substations, and there is no overloading of conductors, he may order ampere tests omitted, but this action must be recorded.

Test Locations

Voltage tests are made on the two regulated phases on each circuit at the point of the first load and at the end of the branch having the lowest voltage. Normally these tests are made on the secondary side of a distribution transformer at the service entrance of a customer as near as possible to the transformer. As far as possible customers having 3-wire service are selected and the voltage measured across the outside wires. If a customer with 3-phase service is available as a test point, both phases may be checked at his entrance provided positive phase identification can be had. If the tap settings on the transformer are unknown or in the opinion of the maintenance supervisor proper accuracy cannot be had by these methods, potential transformers are used. Where graphic voltmeters are used, one is installed in each regulated phase at each test point.

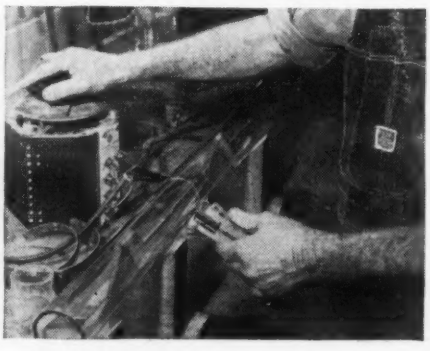
When voltage tests are made with indicating instruments, all tests on a particular circuit are made simultaneously. This usually requires at least four men. The maintenance supervisor insures that all voltmeters have been tested together for accuracy and necessary corrections noted. Testers' watches must exactly agree. Five tests one minute apart are made at each point, starting at a predetermined time. When reading, each tester starts on the even minute, observes his voltage for about 10 sec., and records the average steady potential. Ampere and voltage tests are carefully planned, and the maintenance supervisor personally interviews each man before the day's tests, examines all test results and determines the need of additional readings, if any, also being responsible for proper phase identification.

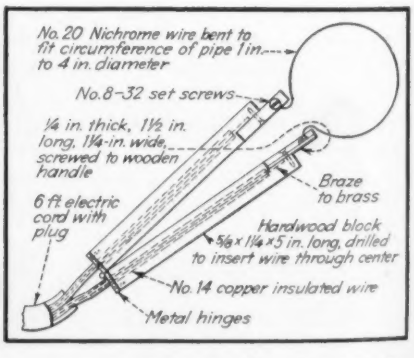
• • •

Cutting Glass Piping Electrically

B. W. WHITEHURST
Engineer, Stone & Webster Engineering Corp., Boston, Mass.

OVER 7.5 MILES of borosilicate (Pyrex brand, Corning Glass Works) glass piping in sizes up to 4-in. diameter were installed by the Stone & Webster Engineering Corp. at the Clinton Engineer Works, Oak Ridge, Tenn., in field fabrication associated with the Manhattan Project for atomic energy research. Over 35,000 cuts were made by the file scratch and hot wire loop method, applied peripherally. This loop consisted of No. 20 Nichrome resistance wire attached to the ends of a pair of handles hinged at the opposite ends. When drawn taut, the wire surrounded within 0.5 in. the circumference of the pipe and overlapped the scratch by at least 0.25 in. at each end. In adjusting the wire for length, allowance for expansion of the wire was made by adjusting it on a piece of scrap pipe.




No. 20 Nichrome wire bent to fit circumference of pipe 1 in. to 4 in. diameter
No. 8-32 set screws
¼ in. thick, 1½ in. long, 1¼ in. wide, screwed to wooden handle
Braze to brass
6 ft electric cord with plug
Hardwood block 5/8 x 1¼ x 5 in. long, drilled to insert wire through center
No. 14 copper insulated wire
Metal hinges

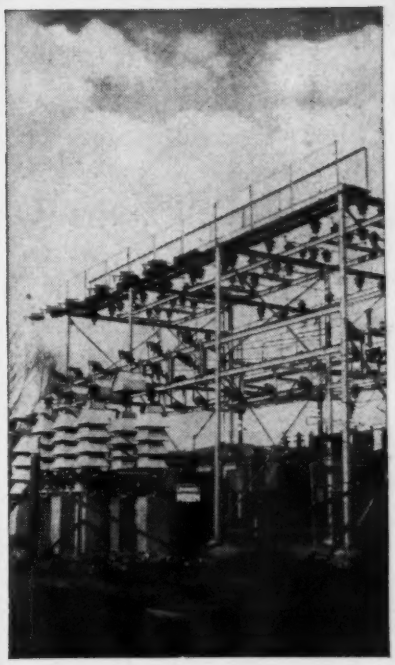
APPLYING hot wire cutter under Variac control to Pyrex pipe. Detail of hot wire cutter (right) used to sever Pyrex pipe at Clinton Engineer Wks., when over 35,000 cuts were required in field

Current to heat the wire was controlled by a 100-Q Variac transformer, the power output being 2,000 volt-amp. The Variac was protected by 20-amp. fuses in the leads to the cut-off tool. A foot switch controlled the heating current. The Variac settings for pipe sizes were: 1-in., graduation No. 7; 1.5-in., 8½; 2-in., 10; and 4-in., 16½. Average heating time, 40 sec. The proper setting supplies enough current to heat the wire dull red when held taut. When all color faded from the wire it was removed from the pipe and a damp cloth applied, first to the score mark and then slowly around the heated circumference of the pipe. The resulting strains usually caused the pipe to break clean. In applying the wire a wrap-around was used, consisting of a piece of impregnated asbestos packing sheeting about $\frac{1}{32}$ in. thick x 2 in. wide, encircling the pipe.

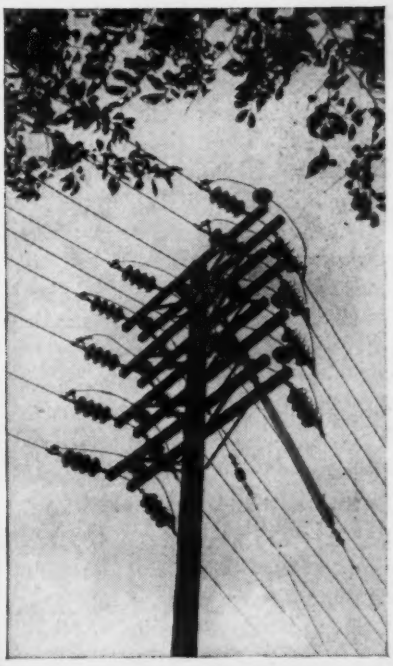
good it is

There were dozens of razors "just alike" when this old-timer was taken from the showcase years ago, and it was a reasonable question to ask, "How good is it?". But there finally comes a time when you forget that sort of question--you *know!*... It's very much the same with insulators. They look alike, specify alike, test alike--are very much alike--when new; but they don't stay new. How do they look 25 years later? The answer to this question is the real answer to an insulator's inherent goodness... Your lines will easily reach the stage of those shown here when you insulate with O-B. You'll forget to ask, "How good is it?". You'll *know!*

2663-H



20 YEARS



28 YEARS

Approximate Voltage Regulation At Different Power Factors . . . II*

K. M. LOVEWELL, Engineer, Potomac Electric Power Co., Washington, D. C.

In accompanying table 2 the values of cosine, sine and p.f. angle in degrees are shown. The values for regulation are taken down to 0.1 p.f. so that dips due to starting of very large induction motors may be determined. For line reactors the transformer tabulation may be used.

A ratio of X = 10R is used as an average for all power transformers. This means that for a transformer with 1 percent impedance the resistance is 0.1 percent and the reactance 1 percent. Therefore, the no-load to full-load regulation on this transformer, if the load is at 0.9 p.f., is

cos times IR + sin times IX

or 0.9 × 0.1 percent + 0.44 × 1 percent = 0.53 percent regulation.

For a transformer with 10 percent impedance the regulation will be 10 times this amount or 5.3 percent.

For a mile of line with 1 percent impedance, a ratio of X = 1.5R means that the resistance is 0.56 percent and the reactance is 0.83 percent since a right triangle with hypotenuse of 1, and one leg 1.5 times the other, has sides of 0.56 and 0.83. The no-load to full-load regulation of such a line if the load is at 0.9 p.f. will be

cos times IR + sin times IX

or 0.9 × 0.56 percent + 0.44 × 0.83 percent = 0.87 percent regulation.

If the line were 20 miles of 69-kv. No. 1/0 O.H. with a peak load of 37,000 kva., the regulation would be 20 × 0.78 × 0.87 percent = 13.6 percent since Table 1 shows such a line to have 0.78 percent impedance per mile at this load. If the peak load were 15,000 kva., the regulation would be

$$\frac{15,000}{37,000} \times 13.6 \text{ percent} = 5.5 \text{ percent}$$

For a line consisting of 34.5-kv., 3-phase, 500,000-cir. mil cable the ratio of X to R is 1.2. This lies between the table values of X = R and X = 1.5R and the correct percent regulation for 1 percent impedance may be obtained very accurately by interpolation.

For a line involving transformers, consider a 7-mile line of No. 2/0 overhead 34.5-kv. conductors with 20,000-kva. transformers 34.5/13.8 kv., 6 percent impedance at each end and a peak load 15,000 kva. at 0.85 p.f.

From Table 1: Line impedance = 1.6 percent at 22,000 kva. and line ratio X/R = 1.7.

From Table 2: Transformer regulation = 0.61 percent for 1 percent impedance at 20,000 kva. and line regulation = 0.89 percent for 1 percent impedance (by interpolation).

Total Regulation of Line:

$$2 \text{ Transformers} = 2 \times \frac{15,000}{20,000} \times 0.61 \times 6 \text{ Percent} = 5.5$$

$$\text{Line} = 7 \times \frac{15,000}{22,000} \times 0.89 \times 1.6 = 6.8$$

Total Regulation = 12.3

An exact calculation gives 12.6.

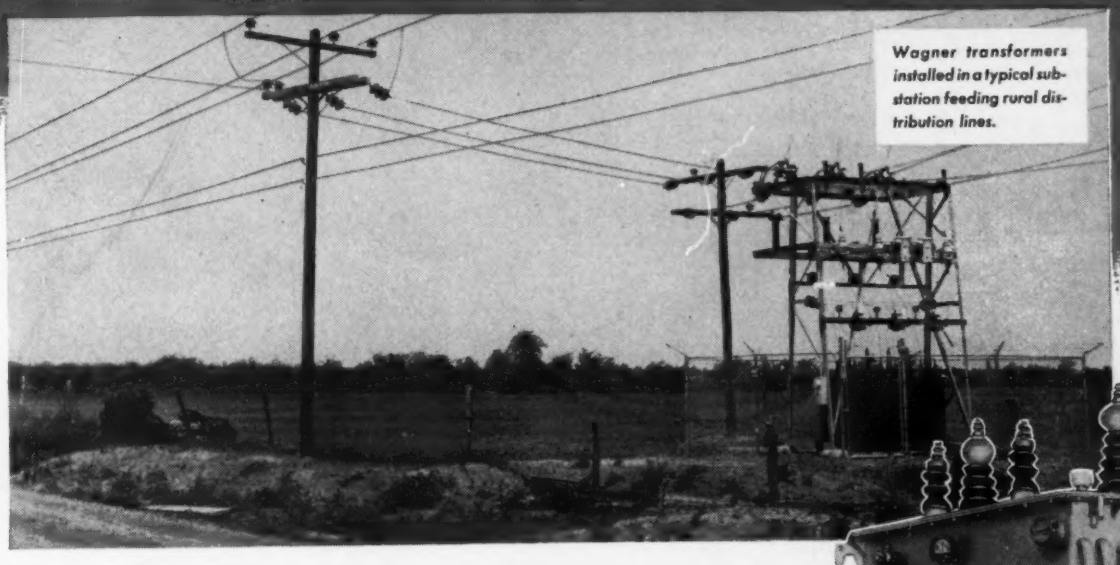
It will be found that this method of calculating regulation will give just as satisfactory results as the most accurate methods because in many cases exact power factor, peak load, operating temperature of conductor and conductor spacing are not readily available. Some of these items are quite often estimated in power system problems and the inaccuracy of the above method is no greater than the inaccuracy of these estimates. For cases of conductor sizes and voltages not listed above, the values can easily be determined and added to the table.

TABLE 2 — REGULATION FOR TRANSFORMERS AND LINES

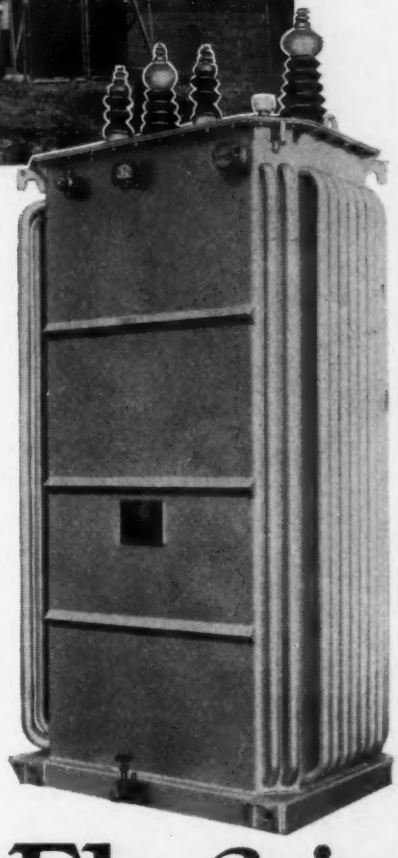
P.F. or Cos	Sin	P.F. Angle, deg.	No-Load to Full-Load Percent Regulation with 1 Percent Impedance				
			Transformers (X = 10R)	O.H. and U.G. Lines			
				X = 0.5R	X = R	X = 1.5R	X = 2R
0.95	0.31	18.2	0.41	0.98	0.89	0.79	0.71
0.90	0.44	25.8	0.53	2.00	0.95	0.87	0.80
0.85	0.53	31.8	0.61	1.00	0.98	0.92	0.85
0.80	0.60	36.9	0.68	0.98	1.00	0.95	0.89
0.75	0.66	41.4	0.74	0.97	1.00	0.97	0.93
0.70	0.71	45.6	0.78	0.94	1.00	0.98	0.95
0.60	0.80	53.1	0.86	0.89	1.00	1.00	0.98
0.50	0.87	60.0	0.92	0.84	0.98	1.00	1.00
0.40	0.92	66.4	0.96	0.76	0.93	0.98	1.00
0.30	0.95	72.5	0.98	0.70	0.89	0.96	0.99
0.20	0.98	78.5	1.00	0.62	0.84	0.92	0.96
0.10	0.99	84.2	1.00	0.54	0.77	0.82	0.93

* Concludes the article begun in Electrical World, November 23, 1946, page 100.

Investigate Wagner
SUBSTATION TRANSFORMERS
for Rural Application--



Wagner transformers installed in a typical substation feeding rural distribution lines.



WAGNER offers a complete range of transformers for rural substations. Call the Wagner field engineers when developing new projects or providing additional substation transformer capacity for existing installations.

Wagner transformers represent the very latest improvements in transformer manufacture, embodying all the latest developments in transformer engineering, and are designed to give many years of dependable, low-cost service. The name Wagner has been synonymous with quality for over half a century.

Wagner builds a complete line of distribution and power transformers, fully described in Bulletins TU-180 (Distribution) and TU-181 (Power). Write for your copies of these bulletins today. Wagner Electric Corporation, 6456 Plymouth Ave., St. Louis 14, Mo.

T46-25

Wagner WE **Electric**

LOCKHEED HYDRAULIC BRAKE PARTS and FLUID...NoRoL...CoMaX BRAKE LINING

AIR BRAKES...TACHOGRAPHS...INDUSTRIAL BRAKES...ELECTRIC MOTORS...TRANSFORMERS

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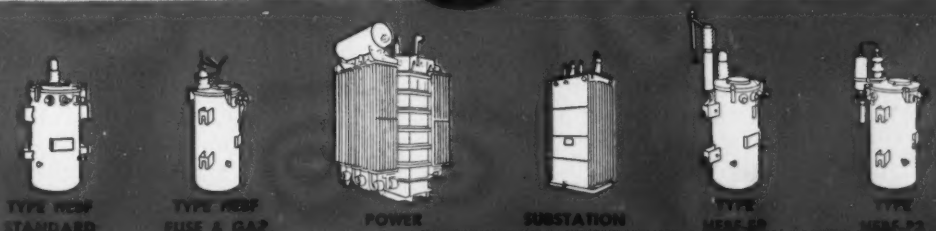
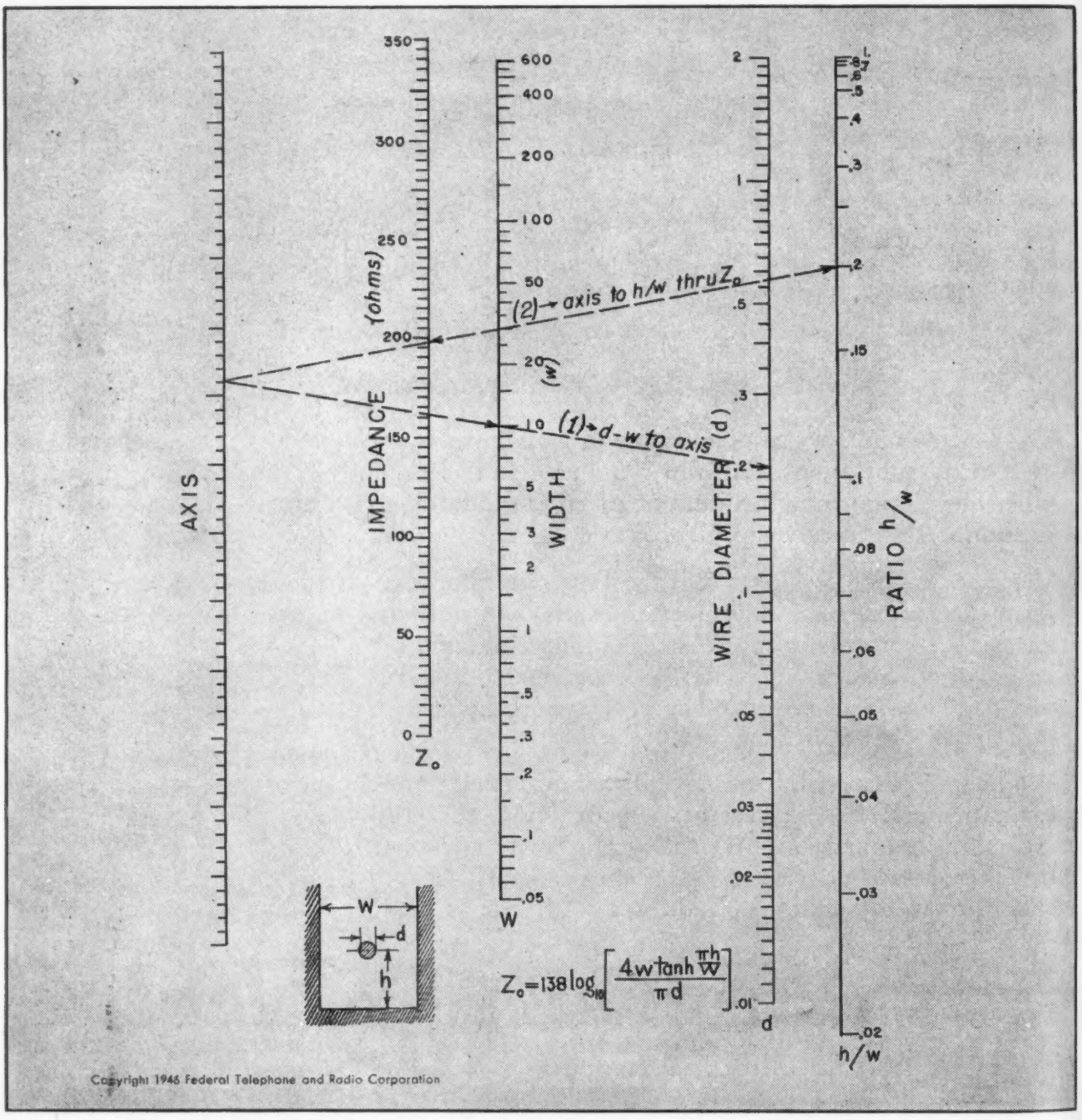


Characteristic Impedance of Lines*

IV—Single Wire in Trough

KARL ZIMMERMANN, Engineer, Intelin Division, Federal Telephone & Radio Corp., New York, N. Y.



To USE THIS CHART, start with d and W values and extend line to axis. From latter point, a line to h/W scale will intersect Z_0 axis at resulting impedance value. Engineering accuracy when $W/d > 3$ and $h/d > 1.5$. Relations are only approximate beyond these values. Assumes lossless dielectric (air) and perfect conductors. Sides of trough assumed to extend to infinity. Any dimensional unit may be used. For other dielectrics multiply Z_0 by $1/\sqrt{\epsilon}$ where ϵ is dielectric constant.

* One of a series of five articles which began in ELECTRICAL WORLD, October 26, 1946, page 92.

AVOID DANGEROUS "SINGLE PHASING"

BY USING

KYLE

AUTOMATIC THREE PHASE OIL CIRCUIT RECLOSERS

Only KYLE gives you
Dual Operating Characteristics

• Many a burned-out motor results from even a short period of "single phasing" when a permanent fault develops on one phase of a three phase system.

Kyle Type "3H" Automatic Oil Circuit Reclosers eliminate this danger. A permanent fault on any one phase will cause the Kyle Recloser to lock out automatically and disconnect service on both the other phases immediately.

Kyle Reclosers perform this vital function with the important additional feature of coordinating with fuse links to keep as great a portion of your lines as possible in service all the time.

Exclusive KYLE dual operating characteristics give:

1 Fast opening on first and second operations. This permits the automatic clearing of temporary faults without damage to sectionalizing fuses.

2 Time delay on third and fourth operations. This allows the affected fuse to blow, isolating the permanent fault, keeping main lines in service.

After the sectionalizing fuse blows, the Kyle Recloser resets itself for another cycle of operations.

For complete information on the protection for three phase lines afforded by Kyle Type "3H" Reclosers see your Line Material Representative.

MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

KYLE Circuit Reclosers are Designed and Manufactured for LINE MATERIAL COMPANY MILWAUKEE WISCONSIN

Miller Saves Time on Generator Reassembly

A PORTABLE MILLING MACHINE with an outsize longitudinal feed has been built by maintenance men of Consolidated Edison Co. of New York, Inc., to help grapple with an alignment problem at the company's Hell Gate generating station.

The new miller is a time saver because it can machine down large surfaces with fewer setting-up periods than are required by conventional models. It is estimated that it saves one-third the time and cost which was required when two smaller millers were used.

Realignments Necessary

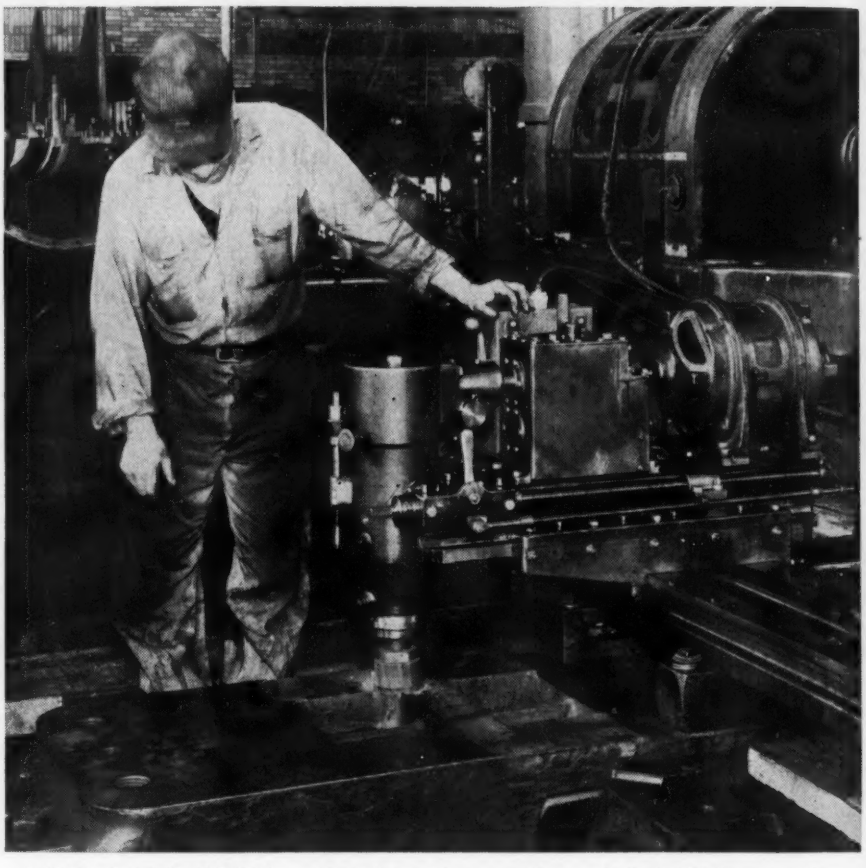
Because of a peculiar condition of growth or expansion of concrete foundations in the Hell Gate station's turbine room area, it has been necessary to make realignments, every three to four years, of the generators and shaft exciters with the turbines. A check of the turbine alignments has shown only a negligible movement, indicating that the foundation growth has been confined to the generator ends of the units.

The station is adjacent to the East River. Its foundations go down to bedrock, which slopes toward the river, and the underground area is continually soaked with salt water. There is a greater exposure to river water on the foundations which support the generator ends of the units. There are several schools of thought concerning the reason for the foundation growth. Edison engineers are not sure what causes it, but they do know how to compensate for it.

When the possibilities of adjusting the height of the generator end of Hell Gate's 160,000-kw. No. 9 unit by the removal of shims had been exhausted, it was necessary to dismantle the unit and machine down the bedplate faces, chairs and bases. Afterwards the air gaps, or spaces between the rotating field and the stationary armature, were equalized by re-shimming. The surfaces were undercut sufficiently to allow for future foundation growth.

The new miller machined off the bedplates for the high- and low-pressure generator outboard bearing pedestals, the low-pressure generator exciter bedplate and the base of the house generator on the low-pressure shaft. More than $\frac{5}{8}$ in. of surface was removed from the house generator base and approximately the same depth from each of the outboard bearing bedplates. The remainder of the necessary milling work was done at the 153rd St. shops of the Edison company and by the Todd Drydock Co. shops.

It is estimated that the new miller handled the necessary work at No. 9 unit in 1,400 man-hours at a labor cost of $2,500. Had the same job been done by the two smaller millers formerly used, it would have taken approximately 2,100 man-hours and a labor cost of $3,750. The important factor is obviously the saving of time since the milling operation had to be completed before the generating unit could be reassembled and put back on the line.



MILLING OPERATION on bedplate of generating unit in Hell Gate station. Milling machine has a longitudinal bed approximately 6 ft. long; tool traverse is about 3½ ft. and drive is by a 2-hp. motor through a speed reducer. Surfaces were undercut to allow for foundation growth

Spot Welder Increases Output of Oil Tanks

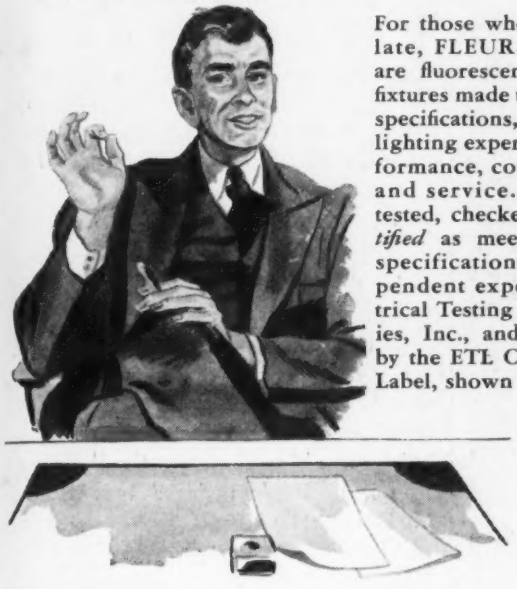
REDUCTION of 25 percent in the over-all production time of its oil dispensing tanks for gasoline filling stations has resulted through the use of a resistance type welder by Hollister Whitney Co. of Quincy, Ill. By that application the company was enabled to step up output 33 percent to meet the heavy demand for re-equipment of gasoline service stations.

By taking advantage of the fact that no skilled labor was required for the operation of the spot welder Howard Ginther, plant manager, reported they experienced no difficulty in training their own men to operate the machine. This was one of the items in question, initially, since one of the product requirements is

The Case of the INQUIRING LIGHTING SALES MANAGER

Chapter Three: HE LEARNS ABOUT FLEUR-O-LIER ADVANTAGES

FLEUR-O-LIER? You said they are . . .



For those who tuned in late, FLEUR-O-LIERS are fluorescent lighting fixtures made to exacting specifications, set up by lighting experts, for performance, construction and service. They are tested, checked and *certified* as meeting those specifications by independent experts, Electrical Testing Laboratories, Inc., and identified by the ETL Certification Label, shown below.

What important *features* do FLEUR-O-LIER specifications cover?

We're glad you asked. They cover electrical and mechanical safety, durability, *Certified* high power factor ballasts, *Certified* starters, efficient lighting performance, ease of maintenance and many others.

Are all these manufacturing standards rigidly maintained?

You bet! Besides the testing done at Electrical Testing Laboratories, Inc., E.T.L. inspectors periodically check samples at the individual factories of FLEUR-O-LIER Manufacturers. That gives you a double check on *uniform high quality* fixtures.

This Label is your clue to good lighting fixtures!

It is your definite assurance of *electrical, mechanical and lighting excellence* in fluorescent lighting fixtures!

FLEUR·O·LIER *Manufacturers*

Fleur-O-Lier is not the name of an individual manufacturer, but of a group of 27 leading fixture manufacturers. Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.

"I know they're good... they're KLEINS

"IF you've ever worked on a pole 50 feet in the air with the wind whistling around your ears, you know why linemen need good tools. That's why there'll always be a pair of Kleins in my tool belt. I know they're good."

Yes, to the men who install and maintain the nation's power and communication lines there is only one kind of pliers . . . Kleins. There's a sound reason for this overwhelming preference. For linemen and electricians—men who know good tools—also know of the quality materials and handcraftsmanship that go into every pair of Kleins. To them this excellence means speed, efficiency and safety on every job.

The complete line of Klein Pliers is in full production but demand still exceeds supply. Your supplier will fill your order as soon as possible.

ASK YOUR SUPPLIER

Foreign Distributor:

International Standard Electric Corp., New York

A copy of the Klein Pocket Tool Guide, showing the Klein line and containing valuable tool information, will be sent on request.

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

WELDING THE TOP to the body of a dispensing tank for lubricating oil

that exterior surfaces of these tanks should be free from weld marks in order that they present a smooth appearance when completed.

With former arc-tacking methods, total time per tank was approximately 2½ hr. but use of resistance welding has beat this by 38 min.

The machine shown in the illustration is a simple pedestal type rated 75 kva., 220 volt, 60 cycle and is a product of Progressive Welder Co. Controls are made by General Electric Co. and include ignitron tube contactor. Throat depth is 48 in. and the arms are designed to accommodate the shape of the tanks. Material used is No. 16 gage hot rolled steel, not cleaned prior to welding.

•

Dielectric Preheating in The Plastics Industry

G. F. LELAND
D. E. WATTS
T. N. WILLCOX*

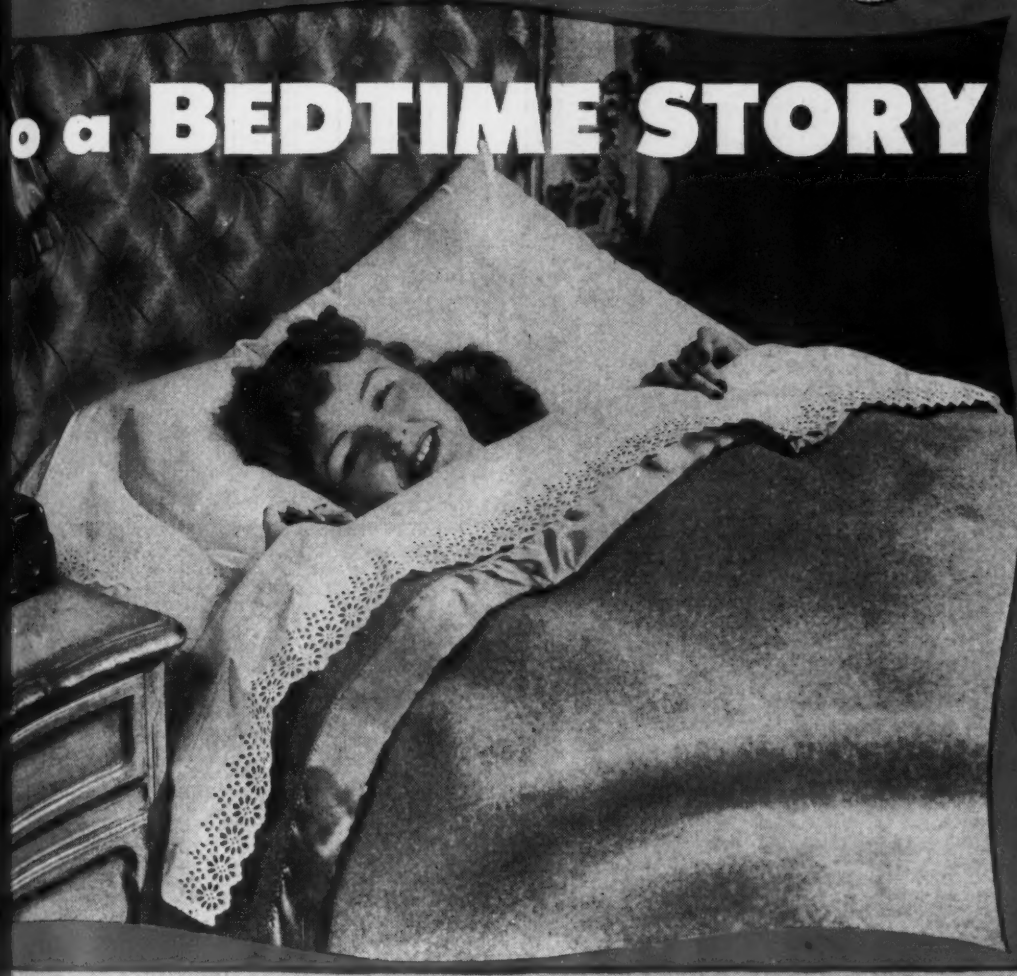
General Electric Co., Schenectady, N. Y.

DIELECTRIC PREHEATING, generation of heat within a charge of molding compound by a high-frequency electric field, has evolved from a laboratory novelty to a recognized production tool in the last three years. Sufficient factory experience is available so that equipment, applications and benefits can be evaluated.

Older methods of preheating using conduction, convection or radiation are limited because a high temper-

* Abstract of paper presented at National Electronics Conference, Chicago, Illinois, October 3-5, 1946.

A NEW Twist to a BEDTIME STORY



A section of the heating element used in Simmons Electronic Blanket, showing waterproof insulation and rayon core. Light wire is D-H 99 Alloy, dark wire copper.

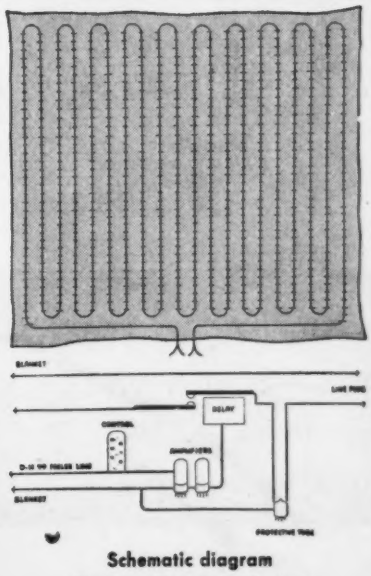
Controlled Sleeping Comfort Made Possible by a *New* Driver-Harris Alloy

SLIP beneath a new Simmons Electronic blanket, turn the control to the temperature desired and relax for a night of comfort.

Separately insulated, but wound together on a rayon core and waterproofed, fine copper wire and even finer D-H 99 Alloy Wire form a network throughout the blanket. The copper wire supplies the heat — the D-H 99 Alloy wire controls it by flashing faint signals to an electronic control box whenever blanket temperature varies as little as 1° C.

Simmons selected D-H 99 Alloy for this highly demanding application because it, alone, met or exceeded every specified requirement. D-H 99 Alloy had the corrosion resistance to withstand washing or cleaning, the fatigue resistance to withstand repeated folding and the constant sensitivity so vital to operating safety and comfort. Only .0039" in diameter, D-H 99 Alloy has a stable temperature coefficient of .00636 per degree C and is dependably uniform from spool to spool.

If your products or processes involve electrical circuits that require a high T. C. of resistance, you'll find D-H 99 Alloy unequalled for these applications.



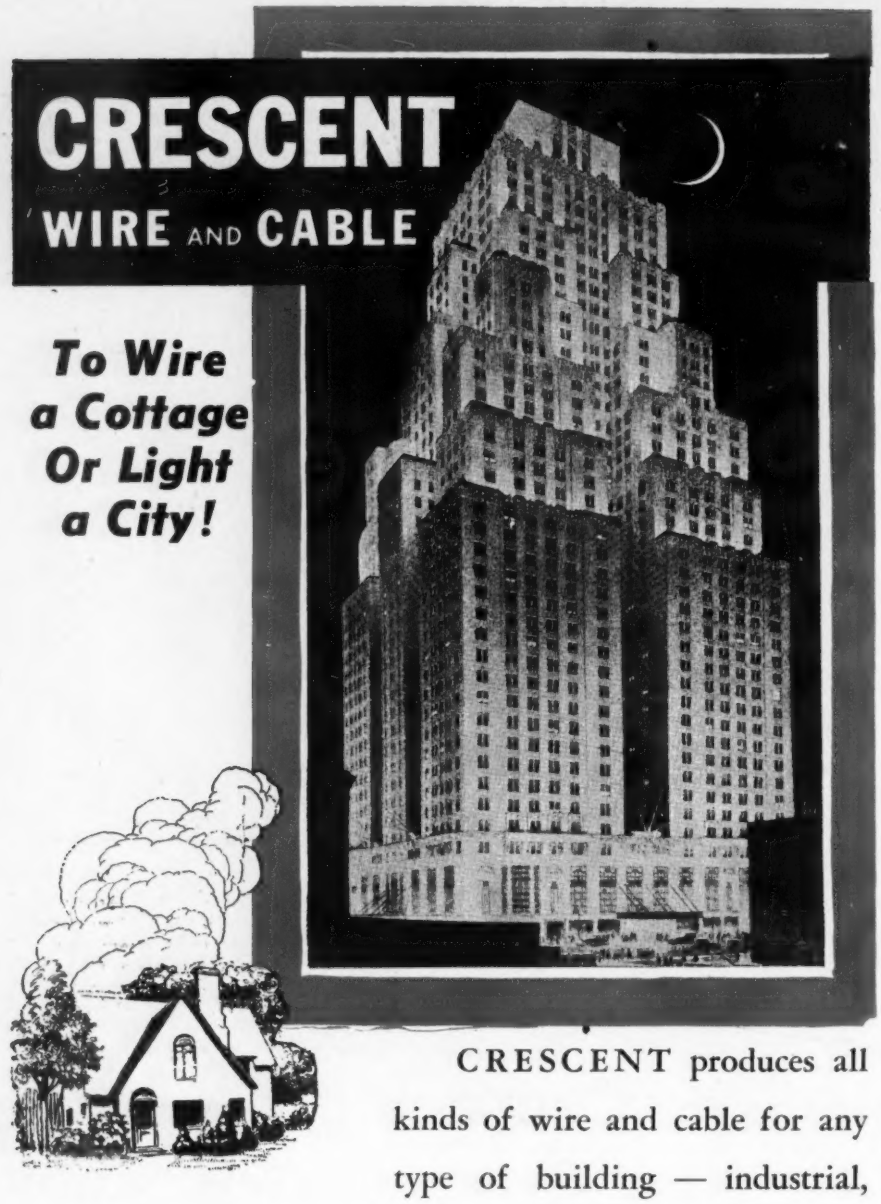
Schematic diagram
Simmons Electronic Blanket

D/H
SPECIAL PURPOSE ALLOYS SINCE 1890

*Trade Mark
Reg. U.S. Pat. Off.

Driver-Harris COMPANY
HARRISON, NEW JERSEY

BRANCHES: Chicago • Detroit • Cleveland
Los Angeles • San Francisco • Seattle



CRESCENT produces all kinds of wire and cable for any type of building — industrial, commercial or residential.

CRESCENT products are sold through electrical wholesalers in every large city in the country to electrical contractors, who know from experience or by reputation the unfailing quality of CRESCENT WIRES AND CABLES.

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, NEW JERSEY

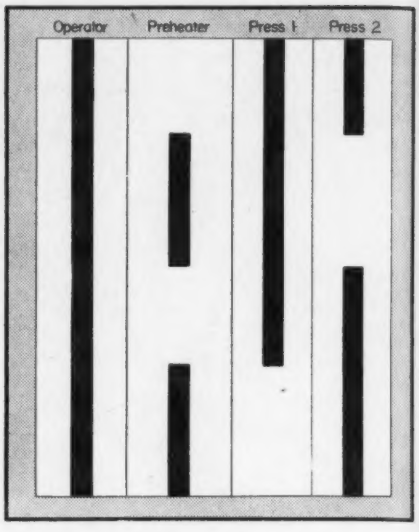


FIG. 1—Shorter preheat time increases the effective use of presses per operator, as indicated in this operation sequence chart

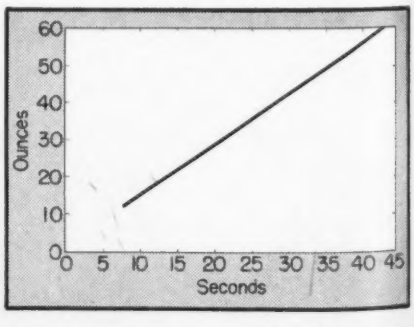
ature on the outside of the charge initiates chemical reaction while the interior temperature is still low. Parts molded from preforms with a surface crust are scrap. Uniformity of dielectric heating is primarily responsible for a 50 percent reduction in scrap.

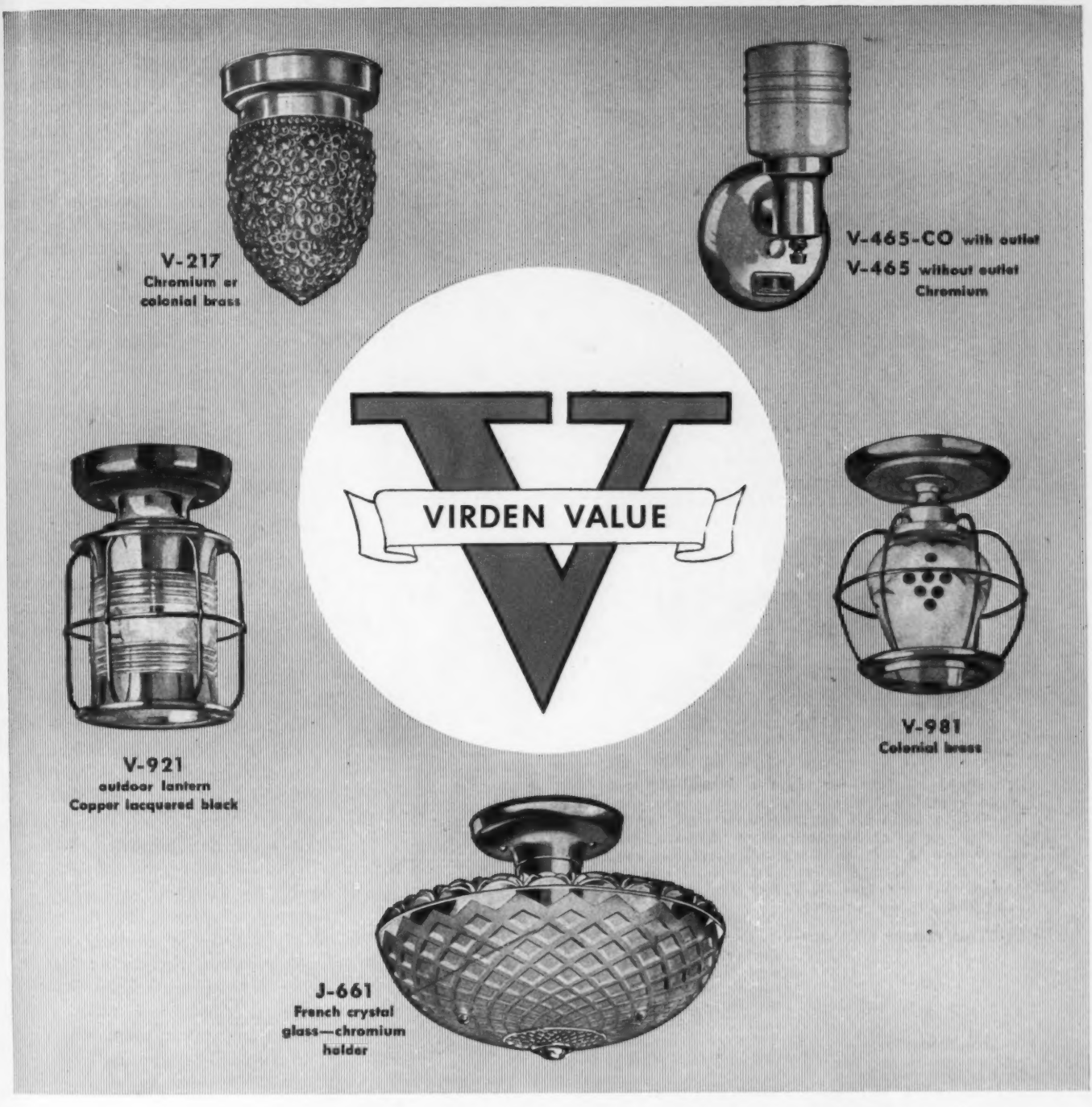
Heating Specifications

Applications to molding shop production requirements must be well analyzed to realize the fullest advantage from the use of dielectric preheaters (Fig. 1). Generally, preheating time varies from 10 to 90 sec. (Fig. 2), with a weight of charge varying from 1 to 60 oz. and a temperature rise between 100 and 200 deg. F. Material characteristics vary in dielectric constants, power factor, specific heat and moisture content. The dielectric strength of the plastic compound places a practical limitation on the voltage that can be used.

The rate of heating is directly pro-

FIG. 2—Performance of 5-kw. dielectric heater—seconds required to heat from 70 deg. to 250 deg. F. for various weights of material





FOR HARD-TO-GET NUMBERS

See Your Virden Distributor

On residential lighting, it pays to ask Virden! For you know you can depend on Virden quality, lighting and value. And you can also be sure of units that are charmingly styled, pleasingly decorative . . . to fit any home need. Shown are a few items that indicate the range of Virden's line. You'll find many more at your Virden distributor—and you'll find him ready to serve you.

John C. Virden Company • Cleveland, Ohio

Member American Home Lighting Institute

Fire Resistive DESTRUCTION That is!*

That's no joke son. Iron and steel do not make a building "fireproof," a term reasonably applied to buildings constructed of steel, brick, concrete, or other noncombustible materials. For a structure is only as "fireproof" as are its contents, and a blazing interior fire would quickly reduce that structure to a shambles of twisted steel and broken concrete.

This picture of destruction is not a pleasant one—nor a needed one. For with ever watchful "Automatic" Sprinkler Protection, fire just doesn't have a chance to make headway . . . it's stopped at its origin . . . damage is held to a minimum.

"Automatic" FIRE-FOG
IT BLANKETS · IT ISOLATES · IT QUENCHES

—a famous member of the "Automatic" Sprinkler Family. Provides adequate protection for quench tank, transformer, oil line and other fires of flammable liquid origin.

Loss of life by fire or cessation of manufacturing and selling operations because of fire is inexcusable. Such losses are needless and incalculable. 24-hour a day fire protection for every business is a must.

Call upon an "Automatic" Sprinkler engineer for assistance on any fire protection problem. He can even show you how savings will pay for installations.

* With apologies to Senator Claghorn

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 37 CITIES

"Automatic" Sprinkler designs, manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories

portional to frequency and to the square of the voltage. With maximum permissible voltage, further increase in rate of heating is obtained by higher frequencies. For example, if at 20 megacycles best heating rate obtainable is 20 sec., then 40 megacycles will permit heating in 10 sec.

A common requirement in plastics molding is met with a preheater of 5 kw., to preheat an average charge of 10 oz. of compound in 10 sec. or less. A frequency of 40 mc. is used. The unit is designed for 460 volts or 230 volts, three-phase.

Higher Frequencies

Experimental work is being done in the heating laboratory at several frequencies higher than 40 mc. For this work at the higher frequency both triodes and magnetrons are being used capable of delivering from 1 to 5 kw. of power at 1,000 mc. These ratings provide sufficient power to allow heating of practical size loads of low loss materials, rather than small items such as laboratory samples.

Equipment designed with a magnetron involves distributed inductance and capacitance instead of the lump circuits usually considered at the lower frequencies and is therefore radically different in design. Whereas the conventional unit, such as the 40-mc. equipment, allows preforms to be placed between parallel plate electrodes for heating, the ultra-high frequency permits heating in a cavity or enclosure made with good electrical conducting walls. Since cavities are totally enclosed, radiation can easily be minimized.

Skin Effect

At ultra-high frequencies, laboratory investigation indicates that skin effect may be troublesome. This effect is directly associated with the conductivity of the material and must be studied for each particular heating job.

Further investigation of the problems associated with the development of ultra-high frequency heating technique is necessary before the full values of the performance for specific applications can be evaluated. The lower frequency equipment has already established itself as an efficient tool for the plastic molding industry. Undoubtedly, the ultra-high frequency equipment will be developed for application to some of the

REGISTRATIONS *SHOW* IT—OPERATORS *KNOW* IT!

"FORD TRUCKS LAST LONGER!"

ONE big reason—

FORD ALL-WEATHER FAST WARM-UP

Ford trigger-fast engine starting often amazes first-time owners. It's mighty satisfying, but not nearly so important as Ford *fast warm-up!* Water does not circulate through the radiator until the engine is well warmed. This speeds the heating of water, cylinder block and oil. Hot exhaust gases are used to heat the intake manifold, speeding vaporization of fuel and minimizing crankcase oil dilution. Both these features reduce wear on cylinder walls, pistons, rings, bearings and valve mechanism. Yes, winter is tough on any truck, but Ford Trucks are engineered to take it.

Ford

The ever-popular Ford Half-Ton Panel —a 7½ foot body, with exceptionally low loading height (24½ inches).

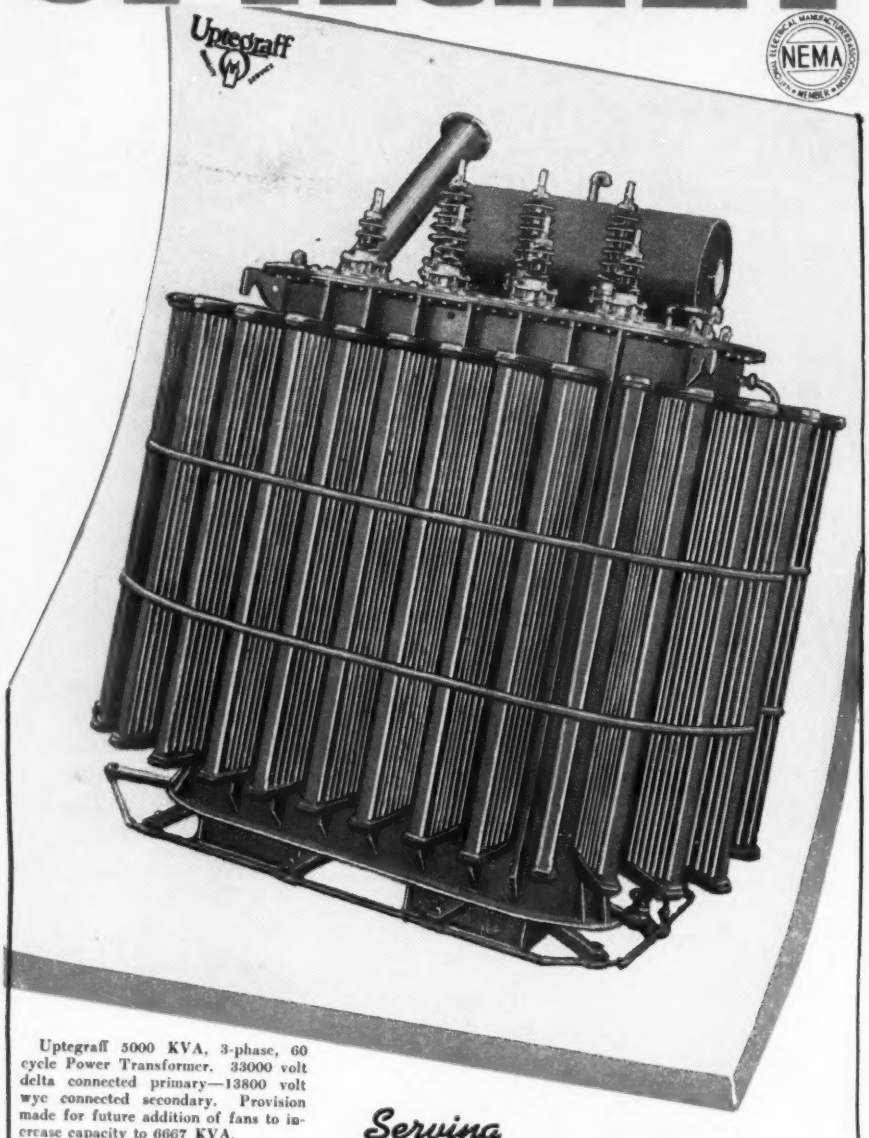
ONLY Ford Trucks offer you *ALL* these long-life features: your choice of two great engines, the 100-H.P. V-8 or 90-H.P. Six—Flightlight aluminum alloy 4-ring oil-saving pistons—weatherproofed, Hi-Volt ignition—full pressure lubrication—axle shafts free of weight-load, even in light duty units—heavy channel section frames, *doubled* between springs in heavy duty models—big brakes, with non-warping, score-resistant cast drum faces—all told, *more than fifty* such examples of Ford endurance-engineering.

No wonder that Ford Trucks Last Longer! No wonder that 7 out of 11 of all Ford Trucks built since 1928 are still at work! No wonder the average age of all Ford Trucks on the job is nearly 9 years! And no wonder your Ford Dealer is calling for ever-increasing truck production schedules in Ford factories! See him now and get *YOUR* order in!

FORD TRUCKS

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE

UPTEGRAFF



Uptegraff 5000 KVA, 3-phase, 60 cycle Power Transformer. 33000 volt delta connected primary—13800 volt wye connected secondary. Provision made for future addition of fans to increase capacity to 6667 KVA.

Serving

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Adapting the design and the construction of Transformers to your exact needs, enables Uptegraff to serve you well in your Transformer requirements.

With a plant that is small enough to be adaptable, large enough to be complete in facilities, and with an engineering force working first of all for the customer, you may find here something beyond what you have ever before experienced.

Send us your inquiries; experience the long-time satisfaction that comes to you with Uptegraff Power Transformers.

R. E. UPTEGRAFF *Manufacturing Co.*

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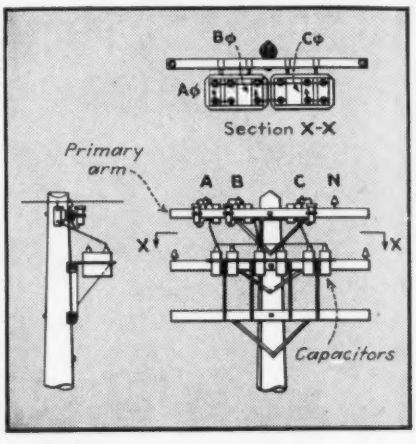
heating jobs that cannot now be handled effectively by present equipment. These investigations are being pursued with a great deal of intensity but much work remains to be done before the full possibilities of the tubes designed for operation at these ultra-high frequencies are realized.

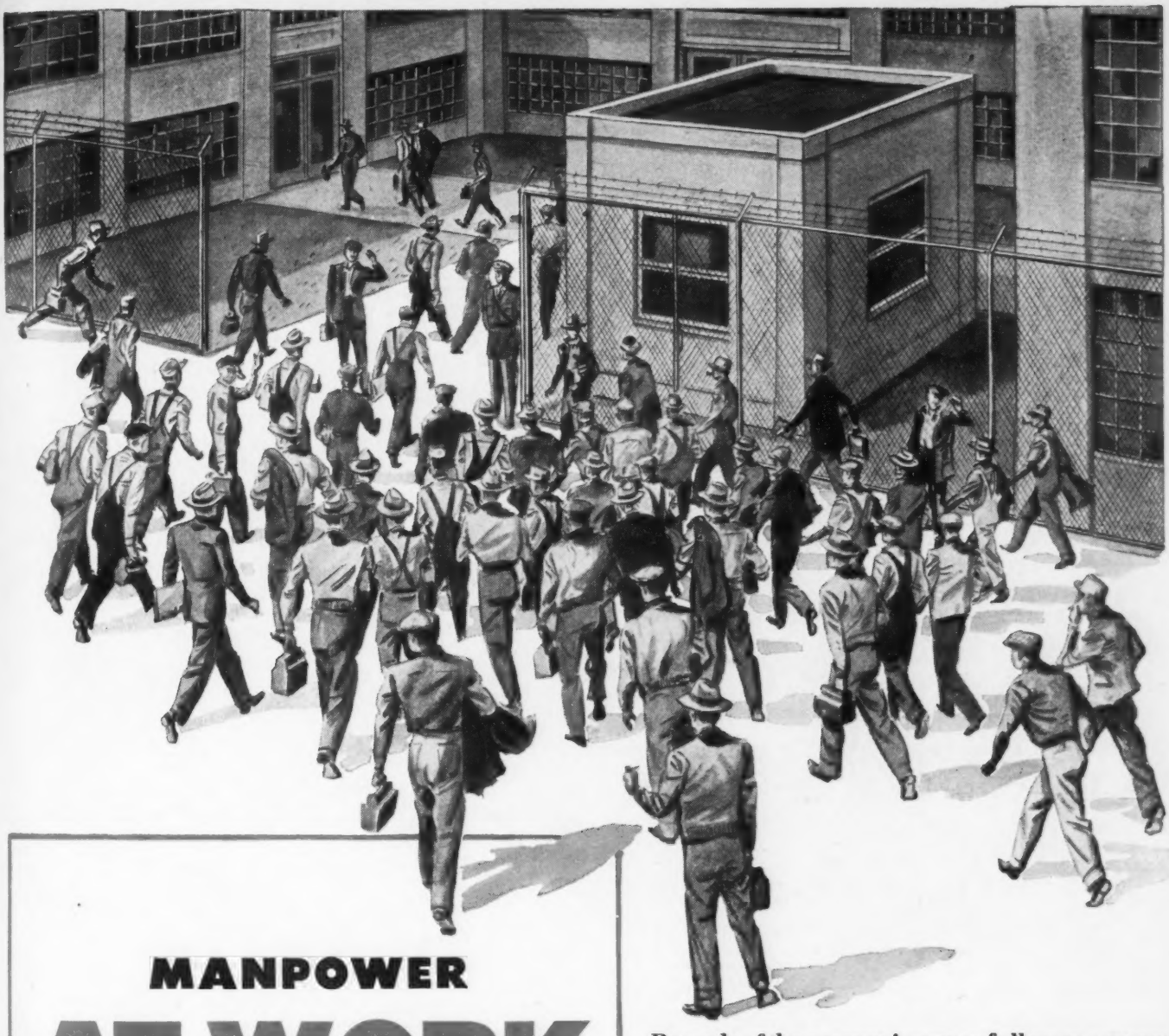
•

How To Mount Static Capacitors



TYPICAL INSTALLATION rated at 90 kva., 3-phase, $\frac{2.3}{4}$ kv.Y for pole mounting layout. Capacitors are not installed on junction poles or on same pole with transformers, sectionalizing switches or cable riser. Hangers are bonded together, ungrounded. Series circuit wires may be carried on end pins of capacitor arm and secondaries on capacitor kick arm

NEW ENGLAND POWER SYSTEM'S handling of capacitors has recently been established on a basis of uniform practice to facilitate proper installation, records and testing of such units, now widely applied in the territory. All single-unit installations are mounted in one-tank hangers, all multi-unit (3-phase) outfits being placed in four-tank hangers. Every unit must be equipped with insulating terminal caps. Each capacitor (which is a plant unit) is assigned an identifying number stamped on a permanently attached brass tag and also stenciled on the name plate end of the unit. The numbering system is a single series starting with the numeral 1 and letter X prefixed. Record cards are kept as for transformers, whose cards may be used for this purpose. On primary maps capacitors are shown, using as a symbol an X within a circle accompanied by an



MANPOWER AT WORK BOOSTS PURCHASING POWER!

Records of the average income of all wage-earners for the past quarter century show an increase of 150% in "real" hourly earnings . . . "real" weekly earnings nearly doubled. Many industries exceed the "average". Industry's ability to create better products that improve living standards, and industry's ability to pay higher wages and higher taxes, come solely through increased production. Slow-downs, or idleness, reverse the advances. Most people know, and admit, these facts. Many need to be reminded often.

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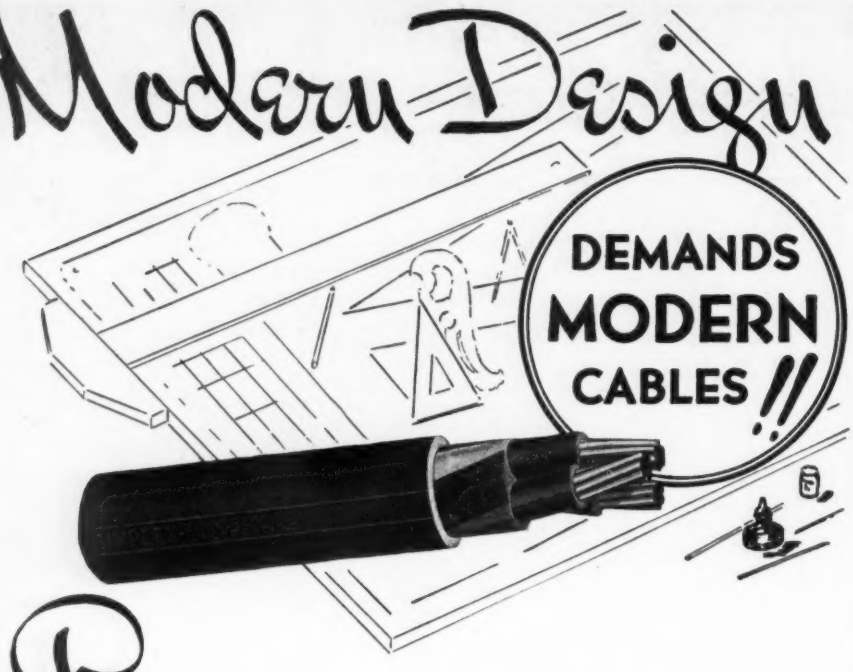
Modern Design



Plans for today's airport, building, and highway construction are thoroughly modern. They call for underground power lines, and with an eye on increased performance at decreased expense specify ANHYDREX* underground cables.

Simplex-ANHYDREX underground cables may be installed in ducts or buried directly in the soil without any outer coverings.

A tough rubber jacket provides protection against the injurious effects of abrasion and acidity, and eliminates the sheath currents and electrolysis common to metallic-covered cables.

The ANHYDREX insulation is the most moisture-resistant rubber compound known to the wire and cable industry and even constant immersion in water will not impair either its physical or electrical properties.

It never pays in savings or performance to be behind the times, but it will to specify ANHYDREX cables for your next construction job.

*Trade Mark Reg. U. S. Patent Office.

Simplex-WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

indication of the kva. connected to each phase, i.e.,

Delta System	Y System
30—AB	45—A
30—BC	45—B
30—CA	45—C

It is required that all capacitor units, when not in actual service, shall be short-circuited by a jumper. This is done by disconnecting the capacitor units from the source of supply and discharging by short-circuiting with No. 6 bare copper solid wire held in place for at least 5 sec. After discharge a jumper of No. 22 copper wire (bare) is attached to both terminals and to the tank mounting flange. This jumper is left in place until the unit is installed, or the work on or about an installed unit is completed. The jumper must not be used as a lifting handle.

Capacitor Tests

All new and returned capacitors are tested as follows:

A. Resistor Test—Resistance between terminals of the unit is measured. A 500-volt megger is most convenient. The nominal resistance is 7.5 megohms, but readings between 5 and 10 megohms are satisfactory. Since the unit is charged to megger voltage after this test, it must be discharged and shorted immediately after testing.

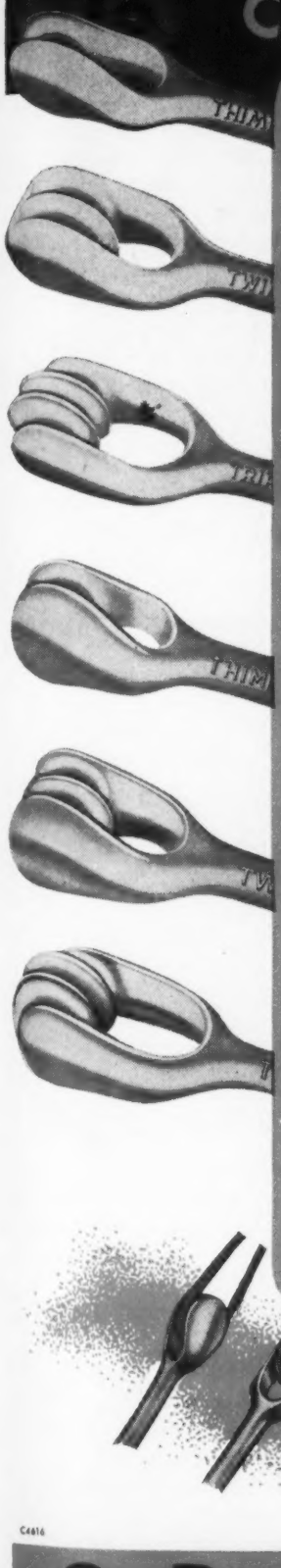
B. Insulation Test — With terminals still shorted, 5.8 kv.a.c. (twice normal plus 1,000 volts, A.S.A. Standard) is applied between terminals and tank for 1 min. Insulation test on returned capacitors is made at 4.3 kv.

C. Capacity Test—Jumper is removed and 2.4 kv. applied between terminals of the unit and current measured. Nominal current for a 15-kva. unit is 6.25 amp. at 2.4 kv., but readings between 6 and 8 amp. are satisfactory. Current drawn varies directly with impressed voltage.

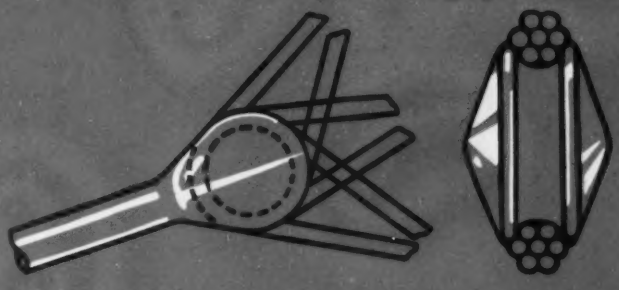
D. Routine Testing—This is not recommended for capacitors in service.

When deenergizing capacitors the cutouts are opened and doors or fuse tubes removed, after which short circuiting and discharge are done as above. Fuses are not replaced in cutouts until all work has been done and the jumper removed. Blown fuses, on single-phase units, combined with transformers, may be replaced without testing to determine cause. On

You Get Extra Strand Protection with CHANCE Improved Thimbleye Rods



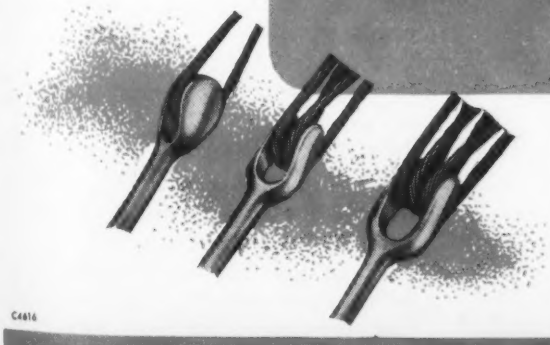
Full rounded to prevent kinking at any angle. Grooved to fit and protect guy strand.

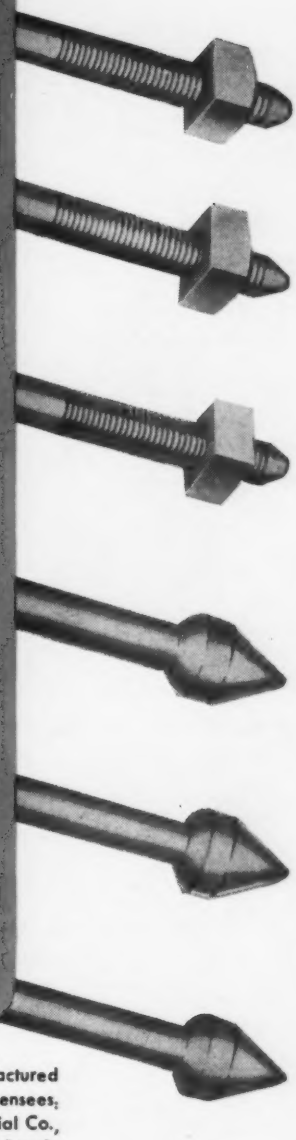


Chance Thimbleye, Twineye, and Tripleye Anchor Rods and Guying Fixtures, which have been the first choice of users for years, have been redesigned to give added protection to guy strands. The improved eye forms a perfectly shaped "Thimble" and the sidewalls and groove of the eye extend around the head of the rod, as shown in the diagram above. This keeps the strand from flattening under tension, preserves its cylindrical shape and prevents it from kinking at any one point. All grooves conform, in depth and width, to the largest cable size used with each rod or guy fixture.

All rods and fixtures are drop forged of steel and are heavily galvanized. Both Never-Creep and threaded rods are available with the improved Thimbleye, Twineye, or Tripleye for use with one, two, or three strands of cable.

For greater line security specify Chance Thimbleye Anchor Rods and get these latest improvements. Order through your regular source of supply.





Chance Thimbleye rods and guy fixtures are manufactured and sold by the A. B. Chance Company and these licensees: Joslyn Mfg. & Supply Co., Chicago, Ill. • Line Material Co., Milwaukee, Wisc. • Oliver Iron & Steel Corp., Pittsburgh, Pa. • Kortick Mfg. Co., San Francisco, Calif. • Seyler Mfg Co., Pittsburgh, Pa. • and N. Slater Co., Ltd., Hamilton, Ontario.

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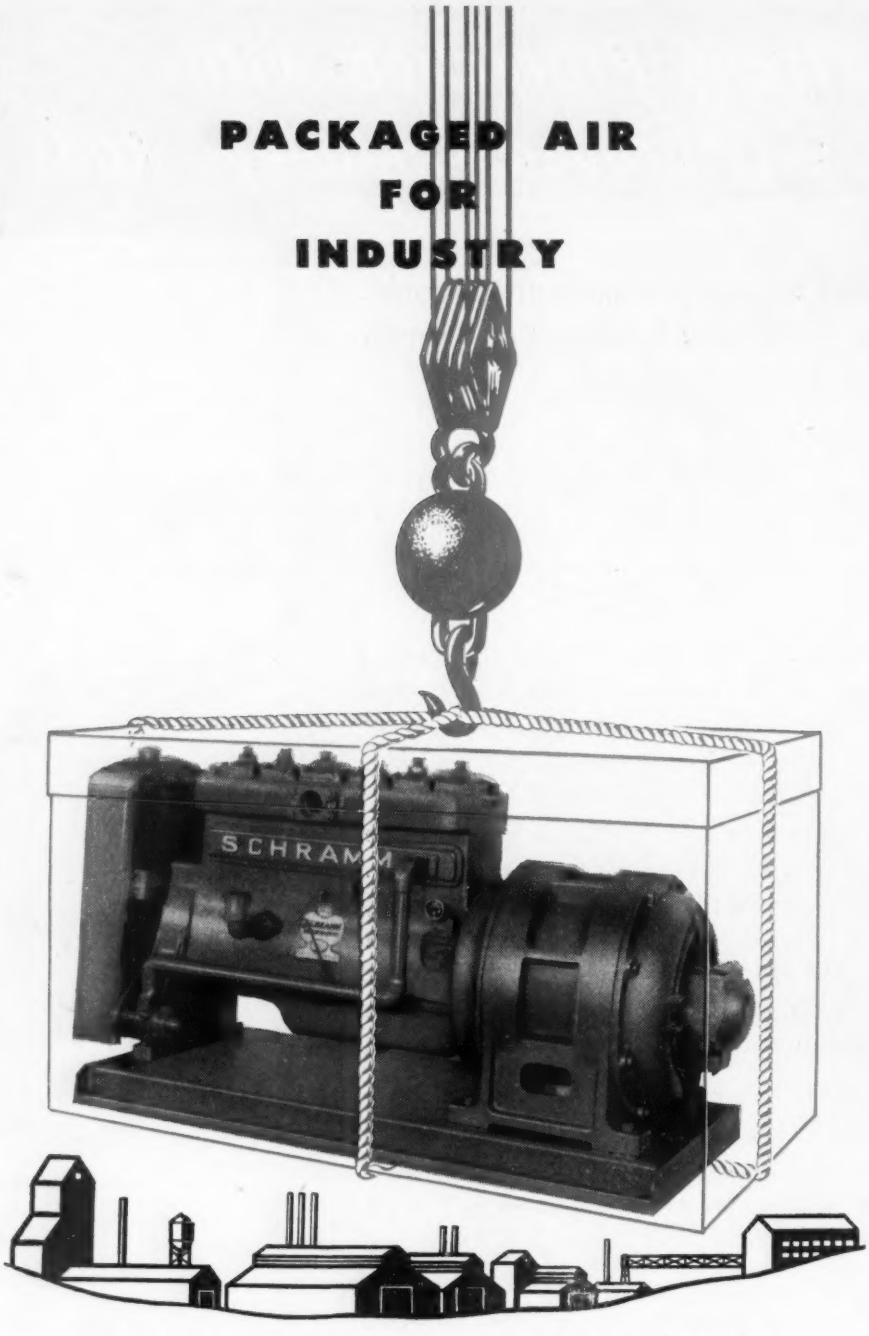
PACKAGED AIR FOR INDUSTRY



Packaged air . . . when and where you need it . . . is always there when you have a stationary or portable Schramm Compressor. Designed for rugged, reliable duty, Schramm Compressors give a continuous flow of air with a minimum of maintenance. Of special advantage to the Industrial Engineer are these Schramm Compressor features:

1. **Completely watercooled to provide ideal performance in winter as well as summer.**
2. **Main bearings for every cylinder.**
3. **Mechanical Intake Valve.**
4. **More cylinders and lighter parts.**
5. **Forced feed lubrication.**

Make your compressed air problems easier by using Schramm Air Compressors. Write today for construction details on these rugged, reliable units.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

3-phase banks blown fuses are not replaced before cause is found. In this case the bank is deenergized and discharged as above provided, omitting the jumper. Each phase is then meggered for short circuit. If short is indicated and more than one unit per phase is present, these are disconnected and each unit tested separately. Shorted units are replaced. If no shorted unit is found, the probable cause of fuse blowing is harmonic resonance at low loads. Linemen working on poles carrying capacitors (but not on these units) are permitted to leave them alive if capacitors and leads can be properly and safely covered with rubber goods. Otherwise the units must be deenergized, discharged and shorted as above provided.

•

Easy Way to Drill Holes In Concrete Ceilings

FOOT PRESSURE device attached to ordinary electric hand drill leaves operator's hands free and makes easy work of drilling holes in concrete ceilings

TAKING A CUE from mining technique, M. H. Nordyke and Duke Ashman, of California Electric Power Co., Riverside, devised the foot pressure attachment illustrated to take the arduous labor out of the common task of drilling holes in concrete ceilings. The device consists of a foot pry with an adjustable extension rod attached to the handle of an ordinary electric drill. Method of mounting and operating are quite evident. This is one of the many worthwhile ideas resulting from the company's employee suggestion plan.

...an aluminum conductor for every bus installation!

Alcoa makes conductors to meet all of your electrical bus needs—for indoors or out-of-doors, for short or long runs, for heavy or light power loads. Aluminum connectors and supports can also be supplied. Joints may be welded, if desired.

DO YOU HAVE THIS BOOKLET?

"Alcoa Aluminum Bus Conductors" contains a lot of general data which are helpful in the selection of conductors and in bus layout. We'll gladly send you a copy.

Alcoa engineers will answer your specific questions on aluminum bus conductors. For this help, call the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM

IN EVERY COMMERCIAL FORM

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

Reinforced Concrete Used for Poles

From an article by H. F. Lidster in "Electrical Review," London, April 12, 1945.

DUE TO the impossibility of obtaining Baltic fir in Great Britain during the war, reinforced concrete was substituted for power line poles. Several advantages have become apparent. Concrete does not shrink, eliminating the need for line inspection for tightening bolts. The appearance is better and the life should be greater. The principal objection is higher cost, but with more extensive use this may be reduced.

Concrete poles are fabricated in seven classes in heights from 30 to 50 ft. and of various designs. The iron content is 300 to 500 lb. Casting is done in a horizontal mold, a fresh batch of mixture being made for each pole.

Once set in position the poles can stand considerable abuse. Care is needed in transit from the point of manufacture to that of erection, but once in place they withstand lateral strains well. Effects of war have been slight. Even though the concrete has shattered in some instances, the iron skeleton has held the pole in place and has provided sufficient strength so that they could be climbed and worked on when detaching the lines for replacement.

Underground 132-Kv. Pressure Cable

From a paper by L. G. Brazier before the Conférence Internationale des Grands Réseaux Électriques, Paris, June 27-July 6, 1946.

THE FIRST three-conductor 132-kv. cable ever placed in service was laid underground in 1944 for approximately 1 mi. on the line between Watford and Gloucester, England, to avoid an airfield. After the cable was laid and jointed, nitrogen gas was forced into it until the whole interior, including joints, was at a pressure of 14 kg. per sq. cm.

Strands of the conductor are not compacted. The dielectric is of impregnated paper, 60 percent manila fiber and 40 percent wood pulp, formed, dried and vacuum impregnated with a naphthene base compound, oil-thickened with a polybutene. This non-resinous thickener insures a good power factor temperature characteristic. Each insulated conductor is covered with metallized paper perforated with small holes to facilitate drying and ingress of compound.

A pure lead sheath 0.322 cm. thick surrounding the conductors is protected with a longitudinal layer of steel strips 0.29 cm. thick and overlaid with two lapped layers of 0.29-cm. steel tape to provide strength to withstand the gas pressure. Outside corrosion protection is given by alternate layers of rubber tape and bitumen-impregnated tape. Dimensions are shown in the table.

The cable was laid in open country in a trench 1.06 m. deep on a bed of 6.6 cm. of sifted soil and covered with an equal depth of soil, then protected with earthenware slabs. The trench was then backfilled.

The method of making joints for this cable was discussed in a previous paper (see ELECTRICAL WORLD, June 22, 1946, page 88).

Details of 132-Kv. Gas Pressure Cable

	Thickness, cm.	Accumulated Diameters, cm.
Conductor, 2.58 sq. cm., 61/0.278 cm.	....	2.13
Dielectric, including metallized paper	1.27	4.67
Three cores, laid up with fillers, pilot cable and gas communication pipe	....	10.0
Tape binder, with copper threads	0.0257	10.05
Lead sheath	0.0258	10.1
Reinforcement tapes	....	11.5
Over-all dimension	....	12.3
Weight of cable	34.8 kg. per m.	
Maximum conductor temperature	85 deg. C.	
Rating when laid in soil at 1 m. deep	450 amp., 105 mva.	
Current density	722.5 amp. per sq.cm.	
Nominal gas pressure	14 kg. per sq.cm.	

Turbine Blade Deposits Reduced

From a paper by M. E. Fitze and F. H. Long (Wisconsin Electric Power Co.) at the Midwest Power Conference, Chicago, April 3, 1946.

UNCONVENTIONAL water treatment was necessary for the 1,300-psi. installation at Commerce Street, Milwaukee, which is primarily the source of steam for the three-pressure heating system in the central district of the city west of the Milwaukee River. The 35,000-kw. turbine is served by a 375,000-lb. per hr. three-drum boiler with combination radiant and convection superheater. Four stages of extraction heating provide feed water at 390 deg. F. The fourth stage is bled in addition to feedwater heating to provide steam for the heater system and auxiliaries. A maximum of 240,000 lb. per hr., together with blow down, amount to some 60 percent makeup.

Stringent conditions with 1,300 psi. required lower hardness to avoid feedline deposits and lower soluble solids as a margin against feedline corrosion than could be obtained with a hot process softener. From the beginning turbine deposits consisted of water-soluble ones in the high pressure and hard tenacious silica deposits toward the lower end.

There is a tolerance for 1½ to 2 ppm. of silica in the boiler water without turbine deposits becoming too objectionable. Addition of 0.5 lb. of magnesium oxide per 5,000 gal. of makeup in the absence of phosphate caused a 5 to 1 reduction in the silica in the water, while in the steam it was 0.05 ppm., with only a trace deposited on the turbine blading. Deposition of sulphates in the radiant superheater caused one tube failure and requires periodic boiling out. Barium chloride has caused a 50 percent reduction in sulphates.

A year's experience with internal treatment of magnesium oxide for silica removal in the absence of phosphate and 8½ months' treatment with barium chloride for reduction of superheater clogging by sulphate has shown no detrimental effect other than the proportionate increase in boiler sludge, and the formation of feedline deposits at the point of injection.

Specify C-D MICABOND

in your Motors and Generators

PRACTICALLY every convenience we now enjoy... the assurance of a fully employed postwar World ...depend on electric generators and motors.

C-D MICABOND... mica electrical insulation... helps keep these generators and motors running.

Generator and Motor manufacturers specify C-D MICABOND because it provides them with the "perfect insulation"—MICA—in usable forms. C-D MICABOND sheets, tubes, rings, segments and other shapes are provided by bonding mica splittings with insulating resins. For complete technical and mechanical data send for Bulletin "M".

C-D PRODUCTS

The Plastics

DILECTO—Thermosetting Laminates.

CELORON—A Molded Phenolic.

DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

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Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

KXC-46

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Continental-Diamond FIBRE COMPANY

Established 1895..Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

LOAD BUILDING

All-Service Selling Builds Load in Grocery

LIGHT of 55 foot-candle intensity makes every item stand out on these grocery shelves

LIGHTING, air conditioning, ventilation, water heating, cooking, refrigeration, and a number of miscellaneous motors comprise the 49.1-kw. load in the new Hill Grocery Co. store in Birmingham, Ala. The remodeled building is 78 x 148 ft. with actual sales area of 78 x 98 ft.

Indicative of the value and public acceptance of this type of merchandising outlet for retail grocery and market operation is the fact that this store did more than a $25,000 business the first week end it opened.

Birmingham Electric Co. commercial sales engineers surveyed the building and recommended planned lighting, as well as other electrical equipment, to give the Hill Co. one of the most modern grocery stores in the South. The recommended louvered fluorescent fixtures were not available, but tests showed that the open-type fixtures, mounted flush on the 13-ft. ceiling in six continuous rows, gave an even distribution of light without excessive glare and offered easy maintenance.

Overhead lighting consists of 138 two-tube, 100-watt fluorescent lighting units, totaling 13.8 kw. of general lighting load, which provides approximately 50 foot-candles in service. There are 3.2 kw. of display lighting over vegetable bins and in meat counters which maintain 75 foot-candles. The vegetable and meat cases are each 65 ft. long. In the meat cases and in the walk-in coolers are fourteen 15-watt germicidal lamps.

In addition to the lighting load, Hill Grocery Co. installed 23 hp. of air conditioning in the new store, 3.2 kw. miscellaneous food machinery, a 3.2-kw. doughnut machine, a 1.6-kw. water heater, and 5.0 kw. of refrigeration which includes meat and delicatessen display cases, open-shelf display cheese case and open-display frozen food cases. As a result of BECO recommendations, a total load of 49.1 kw. was obtained, amounting to a total EAR of $2,006.

The success of this job prompted the Hill Co. to begin on another of its stores. Eventually, all 84 outlets will probably be revamped. Owners of other stores in the vicinity have already asked for BECO recommendations for improved lighting.

• • •

Systematizing School Lighting Surveys

COVERAGE in making school lighting surveys involves foot-candle readings in classrooms (row by row) under both natural and artificial illumination; dimensional data applying to rooms investigated; notations of window locations, wall coloring, reflection factors, ceiling finishes; listing of existing lighting fixtures with their types, makes, lamp sizes, and in necessary cases spacing and heights. The scope of a survey determines whether consideration need be given to school furniture, blackboard locations, use of louvres to cut down glare from outdoor light, and statistical compilations bearing upon pupils' eyesight. Ultimately the development of lighting loads follows the utilization of

School Lighting Survey

Town	School	Supt.	Union No.
Weather condition: Dull / Medium / Bright			Date

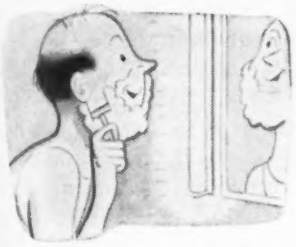
Grade or Room	No. pupils	No. wearing glasses	No. with glasses not wearing glasses	Dimensions: Length	Width	Ceiling height	Reflection factor: A Good, B Fair, C Poor: Ceiling	Walls	Windows: Left side	Right side	Front	Back	Area sq. ft.	Blackboards: Front	Back	Side	Natural Illumination footcandle readings: Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Artificial Illumination footcandle readings: Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Lighting: No. fixtures	Lamp size average	Incandescent	Fluorescent

COLUMN HEADINGS of data sheet used in survey of Maine public schools. Field sheet is 8½ in. x 11 in. to record dimensional and intensity readings under natural and artificial illumination, with other particulars

Bright Ideas

that build lighting load

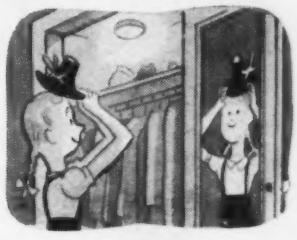
When folks in your community read the December issue of Better Homes and Gardens, they're sure to stop at the big, full-page General Electric Lamp ad and pick up these and other "bright ideas" about lamps for the home—lamps that build load for you! This is typical of the many ways G-E Lamp advertising stimulates popular interest in better lighting, and ties in directly with your local promotion. (If you'd like to check your own "lamp I.Q.", see the answers below.)



1. For safety in shaving,
Good lighting's the rule:
Use G-E fluorescent—
It's bright, soft and_____.

2. It's dandy for baby,
And he thinks it's fun,
This G-E lamp gives him
His own private _____.

3. Why take any chances
With father's eyesight?
To make seeing easy,
Get G-E's Three-_____.



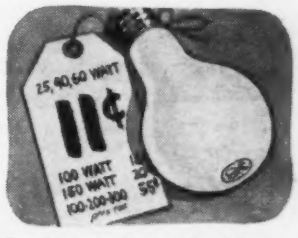
4. When a closet lamp's glow
Tells darkness to scat,
It's easy as pie
To find Mother's new _____.

5. To ease aches and pains,
Or dry things instead,
What lamp would you choose?
G-E _____.

6. Open your icebox,
Find a feast for your eyes,
With a light bulb that's bright
Despite its small _____.

7. Fluorescent for floor lamps
Sounds mighty fine.
It soon will be yours
With G-E's _____.

8. Bulbsnatching's silly,
As most of us know.
G-E's burn so bright,
And the cost is so_____.



9. So the point's simply this—
And we can't make it stronger—
G-E's are the lamps made
To *Stay Brighter* _____!

ANSWERS:

1. *Cool*	4. *Hat*	7. *Circline*
2. *Sun*	5. *Infra-red*	8. *Low*
3. *Lite*	6. *Size*	9. *Longer*

Christmas gift for him or her that'll go to work for you!

Under many a Christmas tree this year, there'll be a gift that can be a load-builder for your off-peak hours ... the famous General Electric Automatic Blanket.

This electrically controlled blanket "works" for you from bedtime to breakfast time, when you need the load most. *Two* Blankets equal one six-foot refrigerator in electrical energy consumption.

Why not mention this gift possibility to your customers? Tell them how marvelous it is to sleep under ONE lightweight covering—while the exclusive Bedside Control adjusts *automatically* to room temperature changes—keeps the sleeper snug all night long!

And there's a big *new* extra this year, too! A new, exclusive Two-Control Automatic Blanket! Two separate controls, one for each half of the blanket, can be set separately.

Double-bed sleepers can *both* snooze comfortably at the temperature *each* likes best.

We're advertising General Electric Automatic Sleeping Comfort in Christmas magazine ads—and on the coast-to-coast radio show, "The G-E House Party."

If you'd like more information about how this marvelous blanket can be a load-builder for *you*, write today ... Appliance and Merchandise Dept., General Electric Company, Bridgeport 2, Conn.

Automatic Blanket

"Goes to work when the lights go out"
Approved by Underwriters' Laboratories, Inc.

GENERAL ELECTRIC

surveys by the public authorities to provide adequate illumination (including wiring and circuit subdivisions); and in some cases surveys lead to the setting up of local codes guiding the authorities in specifying minimum values of lighting in new construction and possibly future renovation.

A cooperative sampling survey recently conducted by the Maine Department of Education, the Central Maine Power, Maine Public Service, and Bangor Hydro-Electric companies, with analysis and report by James O. Peck Co., New York, suggests general techniques which were advantageously followed in field work and its interpretation. The survey covered 434 schools in 130 communities, and 2,185 schoolrooms were investigated, ranging from one-room schools through multi-room, pre-primary, elementary and high schools accommodating 57,386 pupils. Seventeen percent of the pupils had defective vision, and this condition was analyzed according to the number and type of schools and rooms. Eye examinations were made largely by the Snellen test by school nurses. As a result of this survey many communities have taken steps to improve their classroom lighting, both natural and artificial.

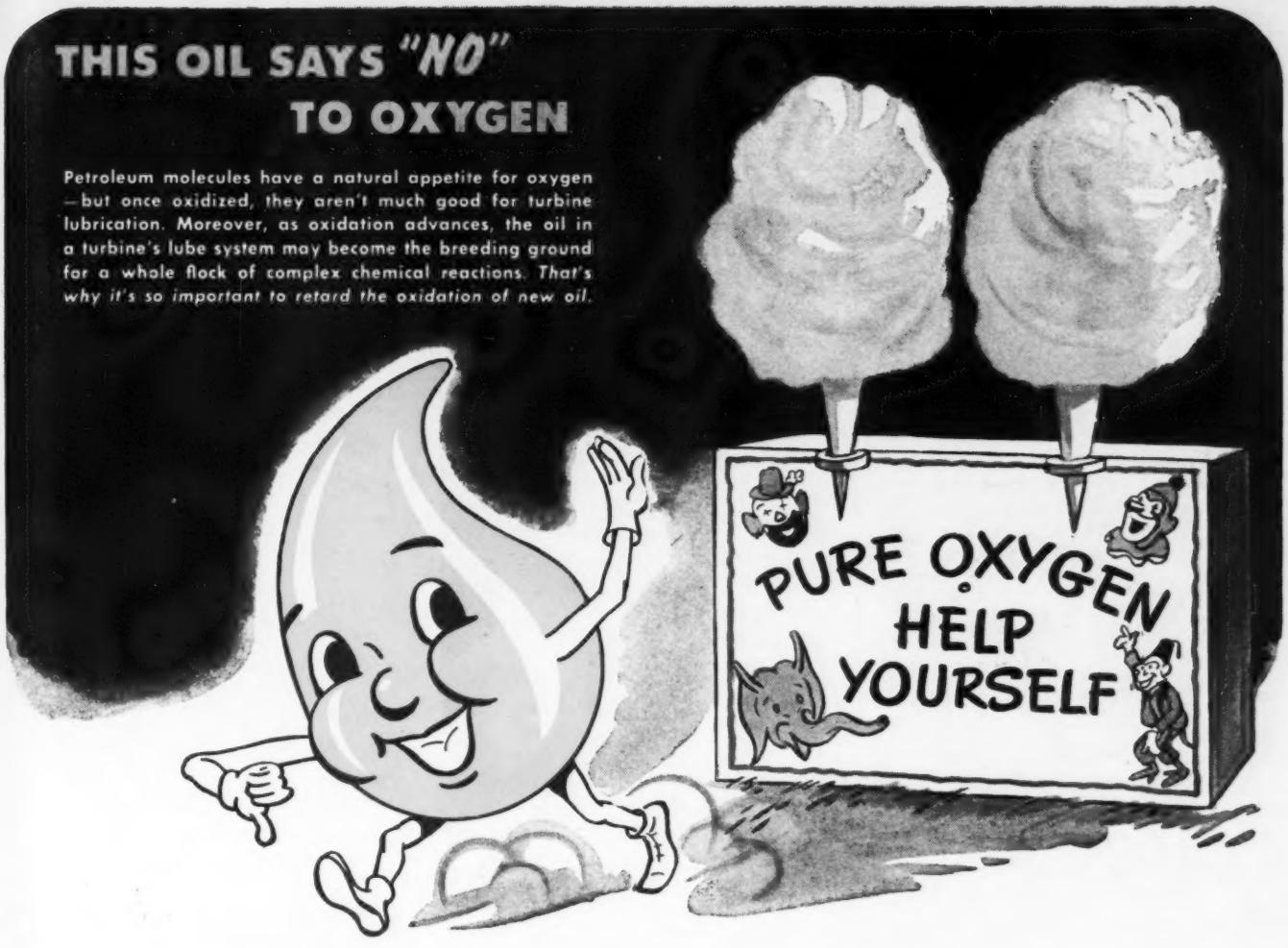
Use of Survey Form

The form used in the Maine survey was a letter-size sheet carrying 37 columns, the top being illustrated herewith. The column headings are largely self-explanatory. The term "row" in the survey means a row of desks in a schoolroom which is parallel to the side walls. Readings were taken in the center of each row, unless directly under a lighting fixture, in which case they were made a little off the center.

Before making the measurements it was customary to make contact with the superintendent, and to ask him to have available the data relative to the number of pupils in the particular rooms to be covered, the number wearing glasses, and the number with defective vision not wearing glasses. Reflection factors were noted by the letters A, B and C. If the ceiling was a good flat white and in good condition, it was classified A. If the upper portion of the walls between the blackboard and the ceiling was either ivory or a lighter color and in good condition, classification A was again used.

THIS OIL SAYS "NO" TO OXYGEN

Petroleum molecules have a natural appetite for oxygen—but once oxidized, they aren't much good for turbine lubrication. Moreover, as oxidation advances, the oil in a turbine's lube system may become the breeding ground for a whole flock of complex chemical reactions. *That's why it's so important to retard the oxidation of new oil.*



Why Shell Turbo Oils
COUNTERACT OXIDATION AND RUSTING
in your turbine's lubricating system

SHELL TURBO OILS show little or no oxidation after years of service in industrial, marine, and public utility turbines. They have successfully prevented rust in these installations.

By counteracting the progressive effects of oxidation, the life of the lubricating oil has been extended far beyond what was thought possible a few years ago. It has been accomplished by four important refining steps:

1. Shell employs scientific selection of crude stocks.
2. Shell's special refining removes all readily oxidized compounds. This also results in better demulsibility.
3. Shell fortifies Turbo Oil with an effective anti-oxidant. Again, by retarding oxidation, better demulsibility is retained.
4. Shell fortifies Turbo Oil with a rust preventive. The elimination of rust is vital to the oil as well as the machine.

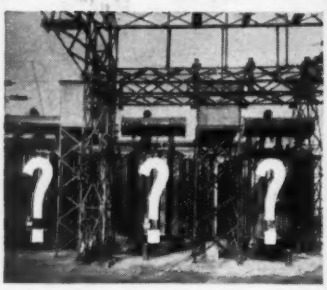
The Shell Lubrication Engineer will give you sound advice about your turbine lubricating problems.

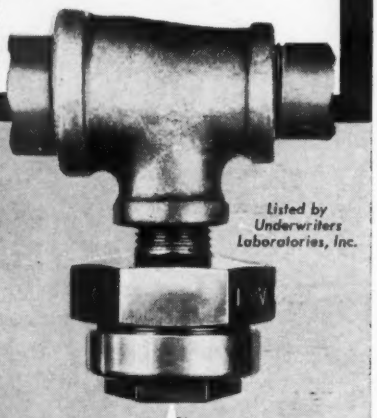
For literature about turbine lubrication and turbine cleaning procedures, write to Shell Oil Company, Incorporated, 50 W. 50th St., New York 20, N. Y.; or 100 Bush St., San Francisco 6, Calif.

SHELL

SHELL TURBO OIL

WHICH WILL BURN FIRST?





Listed by Underwriters Laboratories, Inc.

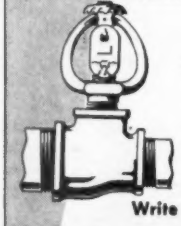
BETTER PROTECT ALL THREE

A fire in one transformer spreads quickly to others.

Blaw-Knox Aquatomic Fog Nozzles properly placed about each transformer, prevent spread of the fire and much of the damage.

Atomized water particles from the Aquatomic Nozzle are small enough for maximum cooling and quenching effect, large enough to carry straight to the base of the fire in spite of drafts, and are non-conducting to electrical current.

Blaw-Knox Aquatomic Fog Nozzles are especially suited to protection of outdoor and indoor transformer banks.



Also—

Standard Wet and Dry Pipe Systems, as well as Thermostatically Controlled Pre-Action and Deluge Systems.

Write for details

AQUATOMIC FOG NOZZLES by

BLAW-KNOX SPRINKLER DIVISION

829 Beaver Avenue, N. S., Pittsburgh 12, Penna.

Foot-candle readings were made at the desk level. In most cases both natural and artificial illumination intensities were made at the same time of day, and shades were generally placed at working levels as guided by teachers.

In the Maine survey it was found that the one-room elementary schools ranged from 0 to 4 foot-candles artificial in 69 percent of the cases; from 5 to 9 foot-candles in 19 percent; from 10 to 14 in 7 percent; and 15 and over in 5 percent of the rows measured. The multi-room elementary schools ranged 38 percent of the rows, 0 to 4 foot-candles; 15.5 percent, 5 to 9; 9.5 percent, 10 to 14; and 37 percent, 15 and over. High schools ran 47.5 percent, 0 to 4 foot-candles; 18 percent, 5 to 9; 8.5 percent, 10 to 14; and 26 percent, 15 and over.

•

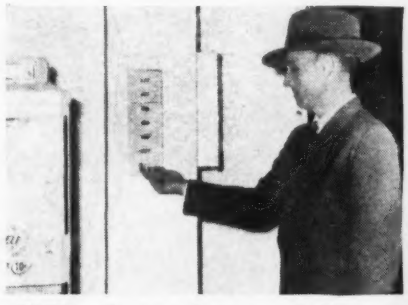
3-Way Remote Control For Market Lighting

ADEQUATE WIRING and convenience of control can be made to enhance the value of lighting jobs laid out by utility lighting specialists by taking a cue from a new market installation in Richmond, Calif. In this 50 foot-candle job, illustrated, three-way master magnetic control was provided to permit turning out the 125, 40-watt, two-lamp fluorescent fixtures comprising the installation from two ordinary toggle switches near the market entrance.

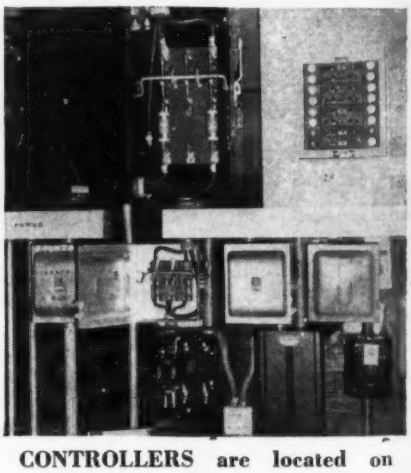
Main service board installation in the rear of the market showing the two magnetic controllers and another set of three-ways between these may be seen in one of the accompanying photographs. Main lighting service through a 200-amp. switch feeds successively into two 60-amp. fused switches; two magnetic controllers; split-bus panelboard, and thence to 32 lighting circuits. Half of the lights in the market are on each of the magnetic controllers, with 14, two 40-watt lamp fixtures in each of seven rows, so circuited that adjacent fixtures are on different controllers. Thus it is possible to turn out half of the lights, uniformly distributed, from either switch at the two master control points mentioned. Adequate wiring was added to adequate control by using No. 12 wire in the lighting circuits and loading them to only 700 watts each.

Cost of the magnetic controllers and the three-way remote control at the front of the store, plus the other features mentioned, added less than $250 to an electrical installation costing several thousand dollars. Thus the market owner secured great convenience in control as well as adequacy at a very nominal cost.

The installation was made by the Modern Electric Co. of El Cerrito, and was engineered by T. J. Curtis, now with Anderson Electric Co. of nearby Lafayette, Calif.



FLIP of two 3-way switches at front door of market operates magnetic controllers illustrated below to extinguish market lights



CONTROLLERS are located on main service board at rear of market. In between the magnetic switches is another set of 3-ways, giving control at that point also

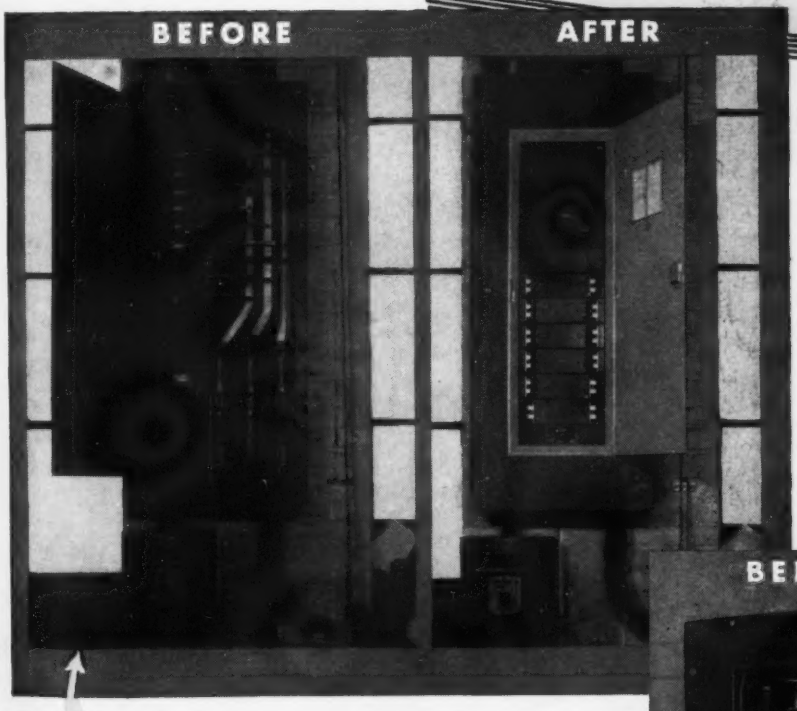
50 FOOT-CANDLE installation in Richmond, Calif., market is circuited with No. 12 wire loaded only to 700 watts to insure normal voltage on lamps

HERE IS A

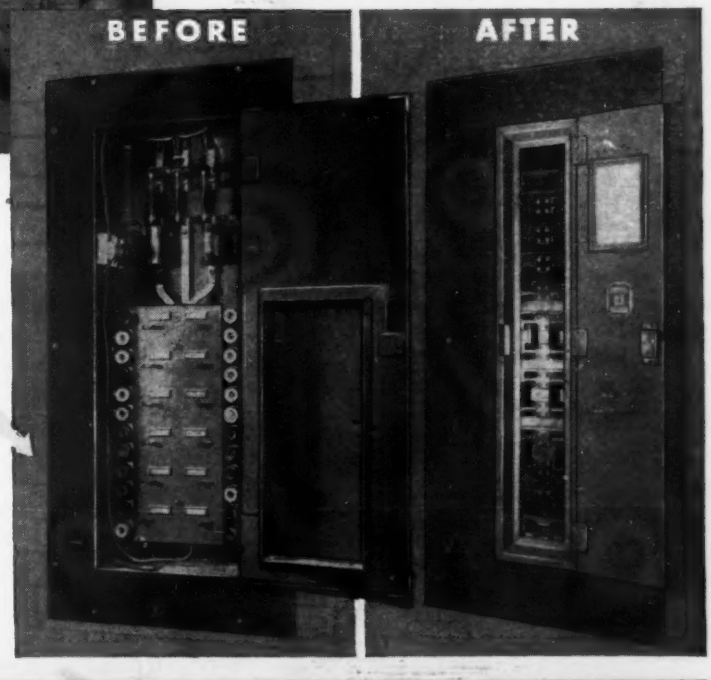
CONVERSION PLAN

THAT REALLY PAYS OUT

• *Here are two typical examples of conversions which involved a minimum of installation time and labor and brought the following results:*



1. *Increased panelboard capacities and added modern circuit breaker convenience and protection.*
2. *Utilized existing boxes and conduit.*
3. *Conserved power previously lost through overloads.*
4. *Eliminated the replacement of branch circuit switches and fuse clips due to excessive heating.*



300% MORE CAPACITY . . .

From three to twelve 3-pole circuits and provision for eight more whenever needed. Existing box was used and no conduits added.

138½% MORE CAPACITY . . .

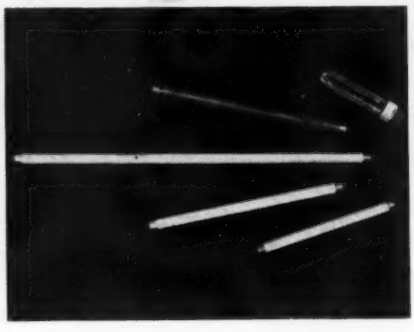
From 13 to 31 single and two-pole circuits. In addition, a needed 3-wire circuit was provided at bottom of panel. A speedy and economical changeover.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

NEW EQUIPMENT

Life Rating Increased On Fluorescent, Germicidal



INCREASED life ratings for three fluorescent and two germicidal lamps have been announced by General Electric Lamp Department at Nela Park headquarters, Cleveland.

The lamps were originally announced with lower life ratings and the company officials point out the present increases represent an additional dollar value to consumers since the lamp cost now buys more burning hours than when the lamps were first made available.

The 6, 8 and 13-watt fluorescent lamps have new life ratings of 2,500 hours as compared with former 1,500-hour ratings. Principal uses of these lamps are in home bed lamps and pin-up lamps and as small inspection lamps in commercial and industrial applications.

The 4 and 8-watt germicidal lamp life ratings were also raised to 2,500 hours. Specialists said these new ratings range higher than 50 percent above original life ratings for these lamps. These small germicidal lamps are in use where ultraviolet radiation is helpful for product protection; to prevent spoilage; to maintain sterilization; to control the rate of fermentation; and to inhibit mold growth.

Lamps bearing the new life ratings are currently in stock. Prices on these electrical discharge lamps remain unchanged, it was stated.

•

Kit Contains Connectors And Installing Tool

A NEW connector kit containing all the essentials for making small-wire solderless electrical connections has been announced by Burndy Engineering Co., Inc., 107 Bruckner Blvd., New York 54, N. Y.

The kit contains 325 assorted Hydent connectors for conductors No. 20 through No. 10 wire as well as the company standard tool for installing the connectors, the latter being packed in plastic jars as illustrated.

•

Panel Type Tachometer Has Separate Pick-Up, Meter

A NEW electric tachometer for permanent installation is announced by Ideal Industries, Inc., 1021 Park Ave., Sycamore, Ill. This unit is designed for use where the "pick-up unit" or generator must be mounted permanently on a machine, and the meter mounted on a panel far removed from the genrator position.

The generator consists of a small, permanent "Alnico" magnet rotor mounted on precision-sealed ball bearings and capable of continuous operation at any speed within the limit of the meter. The meter or indicating instrument is a rectifier type, including a D'Arsonval movement. It is capable f withstanding a momentary overload up to four times the maximum speed indication without damage, the company stated in announcing the new product.

For installation up to 200 ft. the unit may be connected with two conductor No. 18 insulated wire. For longer distances, special consideration as to conductor size is needed.

The meters are rectangular in shape and available in two sizes, 3 in. and 7 in. Both are available in three scale sizes: 0-1,250 rpm.; 0-2,500 rpm.; and 0-5,000 rpm.

•

Electric Boiler Generates Steam Up to 200 Psi.

A NEW BOILER has been put on the market which utilizes electricity to generate steam for pressures up to 200 psi. and in volume up to 2 boiler hp. by the Livingston Co., 89 Broad St., Boston, Mass.

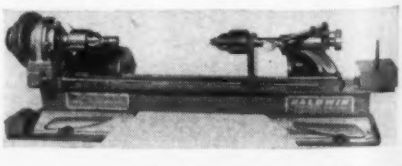
The unit, called Speedyelectric steam boiler, utilizes solid rods for electrodes and the water between them as the resistance element. This permits producing a sizable volume of steam—about 65 lb. per hour—at any desired pressure, in small diameter vessels; such as 8 to 10-in. steel tanks. The low water danger is eliminated because in the absence of water to make a contact between the electrodes no current can pass and, therefore, no steam can be generated.

The control mechanism can be set for any desired pressure by turning a dial.

•

Torsion Machine Developed For Use on Conductors, Ties

A NEW torsion testing machine for wire has been developed by the Sonntag Scientific Corp. and is sold exclusively by the Baldwin Locomotive Works, Philadelphia 42, Pa. The machine will test bronze and copper trolley wire, telephone and telegraph wire and steel tie wire with diameters



HUBBARD-COPPERWELD SECTIONAL GROUND RODS

Hubbard-Copperweld Sectional Ground Rods have been designed for use in locations where deep grounds are necessary to reach firm soil. The use of sectional rods eliminates the nuisance of extra long rods which are clumsy to handle in the warehouse and on the truck. Sectional rods are the same as standard except that they are threaded on each end. Joining is accomplished by couplings as shown. For driving purposes a stud bolt is inserted in the coupling at the top of each section.

Assembly of Sectional Rods—Couplings and Stud

Stock No.	Description	Size	Approx. Wt. per 100 Pcs.
29430	Sectional Rod	1/2" x 10 Ft.	550
29440	Sectional Rod	5/8" x 10 Ft.	860
29450	Sectional Rod	3/4" x 10 Ft.	1220
9533	Coupling	1/2"	18
9534	Coupling	5/8"	30
9535	Coupling	3/4"	46
29533	Stud	1/2"	15
29534	Stud	5/8"	23
29535	Stud	3/4"	35
9491	Safety Set Screw Ground Clamps	1/2"	25
9492		5/8"	35
9493		3/4"	45
9591	Sq. Head. Set Screw Ground Clamps	1/2"	25
9592		5/8"	35
9593		3/4"	45

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.

EXCLUSIVE NATIONAL SALES AGENTS FOR COPPERWELD GROUND RODS AND CLAMPS

Crippling Loss or Quick Extinguishment?

• If a tough, fast-moving fire attacks your plant, is your on-the-spot fire fighting equipment *big enough* and *fast enough* to assure a quick victory?

Cardox Fire Extinguishing Systems . . . using the distinctive Cardox methods of engineered control and application that have greatly broadened the scope of CO_2 fire protection . . . provide outstandingly fast and effective protection for one or many critical or major hazards.

A Cardox Fire Extinguishing System is engineered to definite fire protection standards . . . to provide *all* the advantages of CO_2 extinguishment, unhampered by any practical limitations on the amount of extinguishing medium available, in seconds. By the distinctive Cardox method, carbon dioxide is stored at 0° F. and relatively low pressure in a single ¼ ton to 125 ton storage unit . . . assuring enough Cardox CO_2 to handle even large fires and have ample reserve for new emergencies.

Cardox Engineering and Research Staffs will welcome the opportunity of helping you evaluate accurately the plus value of a Cardox System in the protection of your specific operation.

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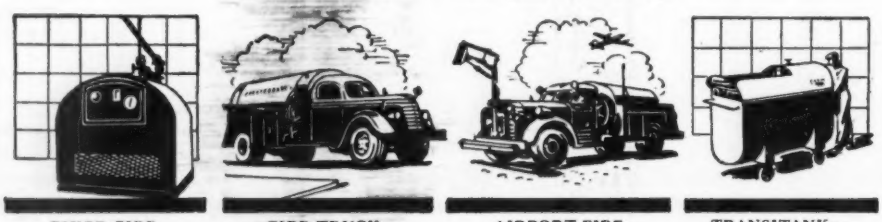

FIXED FIRE EXTINGUISHING SYSTEMS | FIRE TRUCK—Tons of CO_2 on Wheels | AIRPORT FIRE TRUCK | TRANSITANK—Capacity—750 pounds

CARDOX

CO_2 FIRE EXTINGUISHING SYSTEMS

from 0.090 to ¾ in. in accordance with A.S.T.M. specifications. Three testing speeds, 10, 20 and 30 rpm. with reversible rotation, are available with a maximum torque of 1,000 in.-lb. Stresses up to 80,000 psi. can be obtained on one-half inch specimens. The specimen can be preloaded in tension and a reset type counter disengages automatically when the specimen fails.

•

R.R. Signaling Transformer Is Hermetically Sealed

WEIGHING less than 34 lb. complete with pole or cross-arm brackets, oil-filled, railway signaling transformers rated at ½ and ¾ kva. have been announced by the Westinghouse Electric Corp., Pittsburgh 30, Pa.

The transformers are designed with insulation levels equivalent to modern conventional distribution transformers, even though they are approximately the size of a gallon paint can. Economies in line losses and freedom from excessive voltage variations are provided by building the transformers for operation at standard distribution potentials of 2,400/4,160 wye and 4,800/8,320 volts wye. Four external studs provide secondary potentials of 120 volts at plus or minus 10 percent in all ratings at full-load capacity.

The transformers are hermetically sealed. The cover is soldered to the case and all bushings are soldersealed to make an air-tight package.

FILM REVIEWS

Matter and Energy — Differentiates between the different forms of matter, explains physical and chemical changes and the law of conservation. Atomic energy is also briefly exposed. The one-reel film is available in color or black and white and is distributed by Coronet Instructional Films, 919 North Michigan Ave., Chicago 2, Ill.

There Is An Engineering Reason —A 16-mm. color film that shows the steam engineering research activities, and the manufacture, operation, and application of steam auxiliaries under low, medium and high pressure and temperature conditions. This 35-minute film was sponsored by F. J. Stokes Machine Co. and was produced and is being distributed by Hatherm Productions, 264 South Van Pelt St., Philadelphia 3, Pa.

Making Steam Trap History — A 16-mm. color film showing the engineering research in thermodynamics and manufacturing facilities which produce the company's product. The film was produced for Yarnall-Waring Co. and is being distributed by Hatherm Productions, 264 South Van Pelt St., Philadelphia 3, Pa.

CATALOGS and BULLETINS

A monthly digest of recent manufacturers' literature compiled by Electrical World for your convenience in securing without obligation the most recent information on electrical and allied products.

CHECK ON COUPON BULLETINS DESIRED AND MAIL TO US. WE WILL FORWARD REQUESTS TO MANUFACTURERS

1 SYNTHETICS: Twenty-page colored, illustrated booklet covers the uses of synthetics for the electrical industry. Outlines various synthetics, their characteristics, mechanical and electrical properties, and some of their applications in the electrical field. Celanese Plastics Corp.

2 FLUORESCENT LIGHTING: Catalog lists a variety of fluorescent lighting fixtures designed for residential, commercial and industrial use. Statement covering specific application of each fixture is given. Other pertinent data are also furnished. L. J. Segil Co.

3 WELDING EQUIPMENT: Data sheet contains technical information on a welding arc torch used for welding aluminum and its alloys, brass, bronze, red brass, etc. Additional uses are brazing, preheating, soldering, hard surfacing. Harnischfeger Corp.

4 RECTIFIERS: Folder features a new line of rectifiers designed to convert alternating current to direct current for industrial and foundry use. Used to provide source of d.c. power for energizing magnetic separators and lifting magnets. Mellaphone Corp.

5 SWITCHES: Bulletin 36 features unlimited uses for these switch products in gaging devices and in automatic controls. Illustrations of each type of switch are given, showing specific application of each. Schematic diagrams are also given. Micro Switch Division of First Industrial Corp.

6 ELECTRIC TRUCK: A 6-page bulletin entitled "Amazing Push and Pull Power" illustrates uses and specifications of a new transtractor which is a new pushpull type unit combining the features of the electric propelled handtruck and the conventional warehouse tractor. It will tow or push a maximum load of 6,000 lb. continuously or 20,000 lb. intermittently. Complete data concerning its construction, drive unit, motor, breaking system, drive control and steering-mechanism are given. Automatic Mfg. Co.

7 TAPE: Catalog section features a two-in-one tape which weatherseals wire or cable splices in one operation. Advantages are outlined. The B. F. Goodrich Co.

8 GENERATORS: Publication 186 describes and illustrates a newly developed a.c. generator for use in engine generator sets. Provides general-purpose electric power at constant voltage, using a built-in voltage regulating circuit. Photographs and diagrams outline operation details and advantages. Generator ratings are from 5 to 15 kw. Electric Machinery Mfg. Co.

9 REGULATORS: Bulletin 42-8 contains 12 pages of detailed technical information covering line regulators and transregulators. Illustrations are furnished. Construction drawings, wiring diagrams and characteristics of control circuit curves are also given. Kuhlman Electric Co.

10 TRANSMISSION STRUCTURES: Bulletin 15 shows briefly some of the possibilities in the design of wood transmission structures. Drawings covering complete construction details cover many types of overhead line construction. Includes engineering data. Hughes Bros.

11 MOTOR GENERATORS: Brochure covers a variety of motor generator sets in capacities ranging from ½ to 20 kw. Also includes motor generator sets used for battery charging, electroplating, etc. Illustrations are included. The Hobart Brothers Co.

12 CONTROL INSTRUMENTS: Bulletin pH 1302 describes continuous pH controllers and recorders. Includes also information concerning electrode assemblies and accessories. Engineering and technical information relative to pH theory and measurements are given. A variety of installations are described, with chart records, photographs and flow diagrams included. The Bristol Co.

13 LIGHTING EQUIPMENT: Catalog contains illustrations and descriptions of a variety of lighting fixtures designed for offices, stores and institutions. Specifications and drawings with dimensions are given. Price list is also included. Leader Electric Mfg. Co.

14 METERS: Bulletin 221A describes a variety of meters designed for coal and granular materials. Illustrations and technical data are submitted. Charts and drawings showing accuracy of meters are shown. Tables showing tests and results are also given. Bailey Meter Co.

Circle numbers, sign and mail *Coupon good until February 1, 1947, only*

December 7, 1946

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NEWS ABOUT PEOPLE

Hartford Electric Light Co. Promotes H. K. Williams

Harry K. Williams, who has been connected with the Hartford Electric Light Co. since 1922, has been appointed superintendent of distribution to succeed Charles M. Yale, retired.

H. K. WILLIAMS

Mr. Williams has been serving as assistant superintendent of distribution since 1936. He is a graduate of Rensselaer Polytechnic Institute.

Mr. Yale has been identified with the Hartford utility for 46 years and has been superintendent of distribution for the past 34 years. Entering the company as a stockroom clerk, he was intimately identified with both construction and operation of its transmission and distribution facilities, including the celebrated Hartford-Agawan line of the Connecticut Valley Power Exchange.

•

▶ COL. WILLIAM KELLY, chairman of the executive committee of the Buffalo Niagara Electric Corp., has been appointed community chairman for Buffalo of the Committee for Economic Development.

▶ DR. EDWIN E. WHITEHEAD, who recently was appointed research professor in Illinois Institute of Technology's electrical engineering department, has been appointed secretary of the Midwest Power Conference. Dr. Whitehead will succeed Charles A. Nash, IIT professor, who has had a seven-year tenure in office. Before joining the IIT teaching staff, Dr. Whitehead was associated with the Duquesne Light Co. for 14 years as research supervisor, operating engineer, investing engineer, and general engineer.

•

Institute of Radio Engineers Elects Baker President

Dr. W. R. G. Baker, a vice-president of General Electric Co. in charge of electronics with offices in Syracuse, N. Y., has been elected president of the Institute of Radio Engineers. He succeeds Frederick B. Llewellyn of Bell Telephone Laboratories and will take office shortly after the first of the year.

Dr. Baker is well known in the expanding electronics industry, particularly in the fields of FM radio and television. He holds many other important offices, such as director of the engineering department of the Radio Manufacturers Association; member of the Board of Governors of the National Electrical Manufacturers Association; and chairman of the electronics committee of the American Institute of Electrical Engineers. He has held other prominent positions as chairman of the National Television Systems Committee of the television industry, and was the first chairman of the electronics industry's Radio Technical Planning Board.

W. R. G. BAKER

Dr. Baker has been in charge of the G.E. electronics department since its formation in 1941.

F. R. Lack Elected President of ASA at Annual Meeting

Frederick R. Lack, vice-president and a director of Western Electric Co. in charge of its radio division, was elected president of the American Standards Association at the recent annual meeting in New York.

F. R. LACK

Mr. Lack became vice-president and a director of Western Electric in 1942 after a career with the Bell Telephone System which began in 1911. During the recent war he was for a time director of the Army and Navy electronics production agency.

He is a director of the Institute of Radio Engineers and the Radio Manufacturers' Association and is a member of the American Institute of Electrical Engineers and the American Physical Society.

•

▶ RAYMOND E. LEE, vice-president of the Houston Lighting & Power Co., Houston, Tex., has resigned. Mr. Lee has completed 31 years of service.

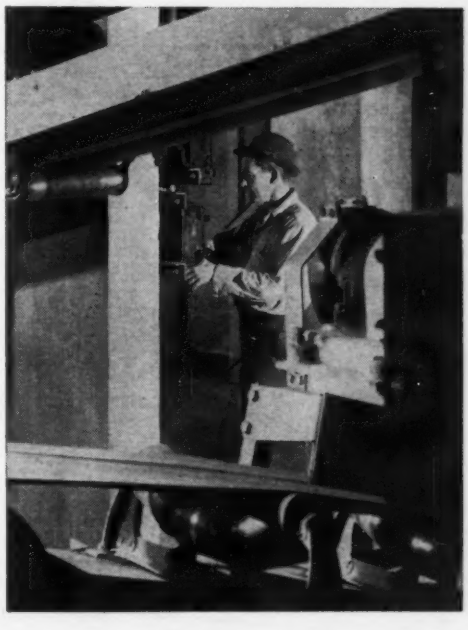
▶ DR. E. F. W. ALEXANDERSON, consulting engineer of the General Electric Co., has been awarded the Danish Gold Medal by the Royal Danish Academy of Science for his work in the technical radio field. A native of Sweden, Dr. Alexanderson has been connected with General Electric since 1902. He holds many scientific and engineering awards, including the Edi-

GIVING DUST THE BRUSH-OFF

Result: . . . better working conditions

Heat and dust from top charging furnaces are drawn off at source, instead of being disseminated throughout the steel foundry of the Chapman Valve Manufacturing Company at Indian Orchard, Massachusetts.

The complete plant . . . offices, health clinic, laboratory and production facilities . . . was designed and built by Stone & Webster Engineering Corporation in 11 months from date of authorization.



STONE & WEBSTER ENGINEERING CORPORATION

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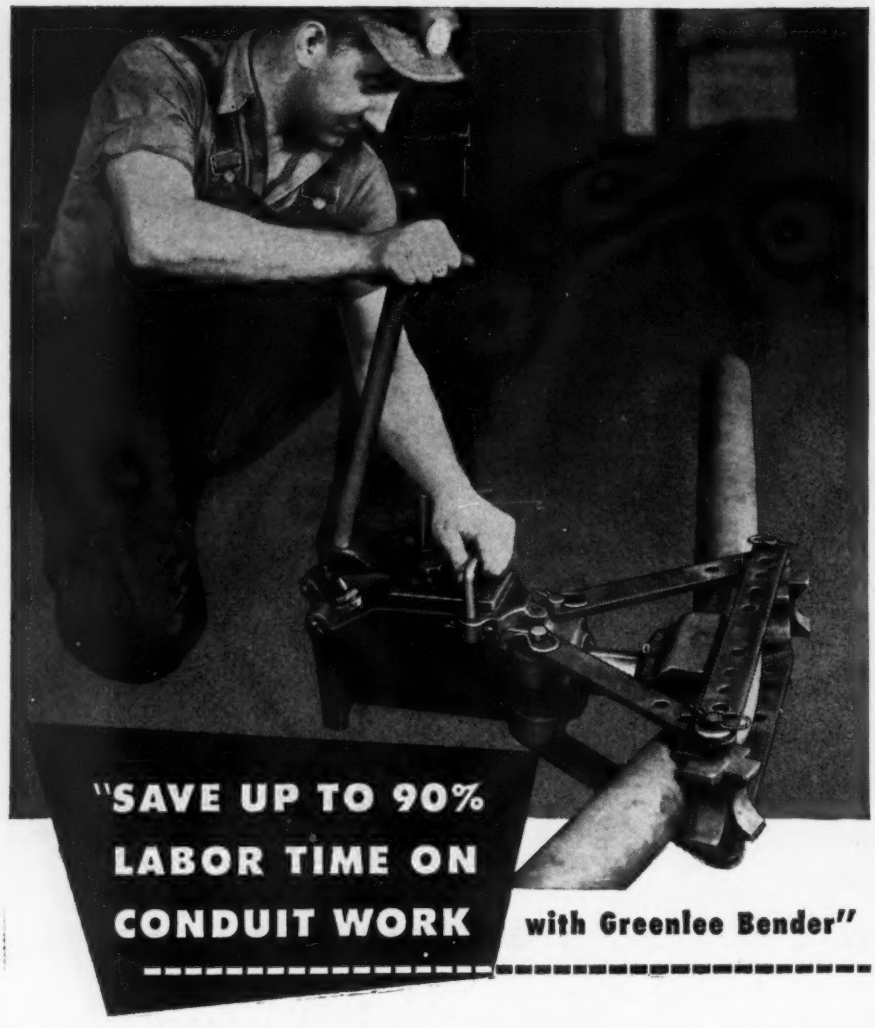


Yes, these great labor-savings... plus savings of about 50% on fittings and manufactured bends . . . are reported by G. B. Bolander, Chief Electrician and Maintenance Superintendent for the Buckeye Traction Ditcher Company, Findlay, Ohio.

"Our factory is full of examples where large timesavings are made with the GREENLEE . . . it is all a definite and unusual performance record," he further states.

Here again is just another example of how well it pays to have a GREENLEE Hydraulic Bender on the job. Other users report 50%, 75%, and up to 90% labor-savings, too.

And the reason is simple: In but a few minutes, *one man* can easily make *accurate*, smooth bends with a GREENLEE—in pipe up to 4½", rigid and *thin-wall* conduit, tubing, busbars. Compact, portable, easy to carry, set up and operate when and where wanted!

For complete information on GREENLEE Hydraulic and Hand Benders to speed your jobs, write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1812 Columbia Avenue, Rockford, Illinois.

80th Anniversary
1866-1946

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Knockout Tools • Pipe Pushers

son medal of the American Institute of Electrical Engineers for 1944, and more than 300 patents on various types of electrical equipment.

OBITUARY

Herbert W. Young

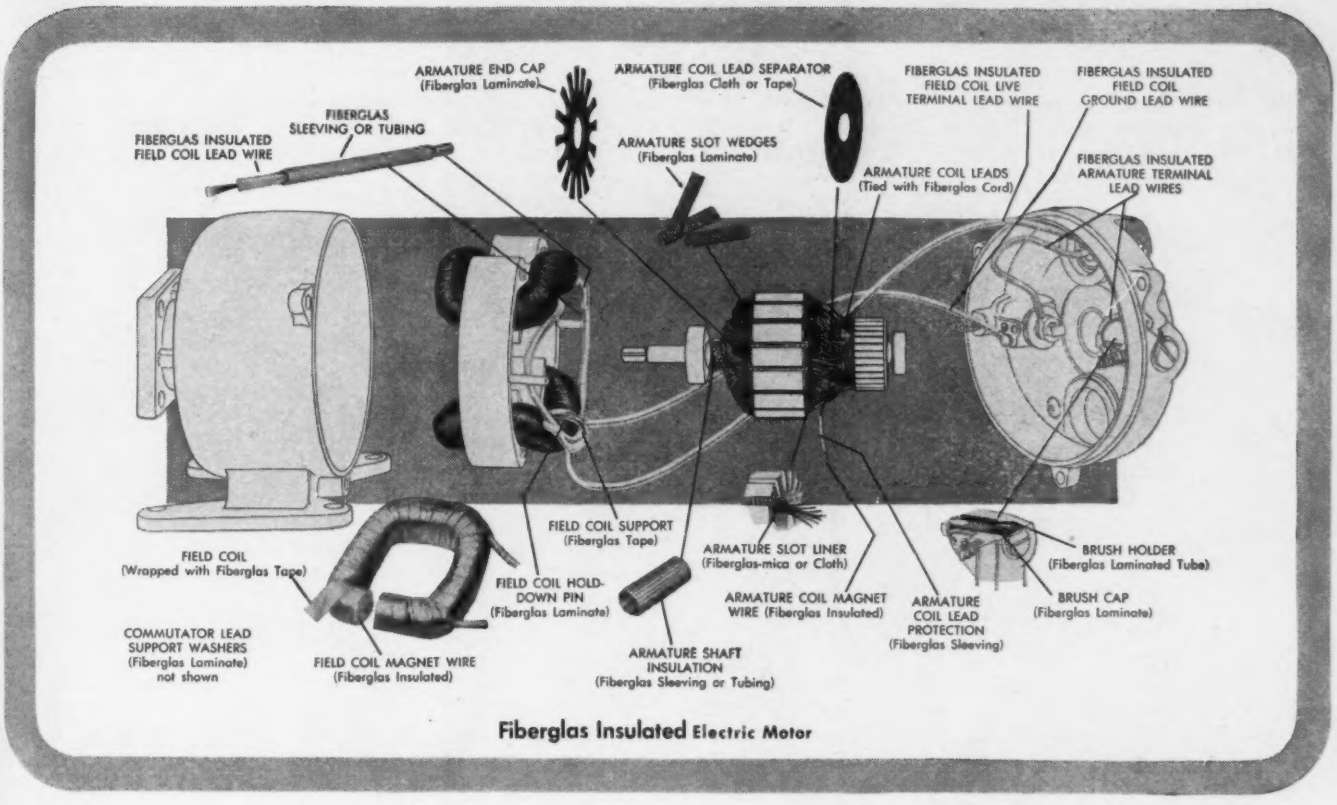
Herbert W. Young, president of the Delta-Star Electric Co., Chicago, whose death was announced in the November 30 issue of ELECTRICAL WORLD, page 8, had been prominently identified with the electrical industry since 1908, when he and Allen S. Pearl incorporated the

Delta-Star company. In the early days of his business he was at the same time inventor, designer, builder and salesman. Under his guidance as president since 1908, the company pioneered many important developments in the higher tension electrical field, and today is a leader in this industry.

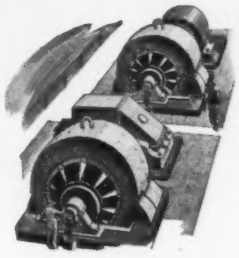
Born September 4, 1875, Mr. Young entered the employ of the Whitney Electrical Instrument Co. of Manchester, N. H., in 1892. The company removed to Penacook, N. H., in 1894, where he remained until 1898. Then going to Lynn, Mass., with the General Electric Co., he was first in the instrument assembly department, next in the engineering division and in 1902 was transferred to Schenectady where he was associated with C. D. Haskins and F. G. Vaughen. Subsequent connections were with the National Electric Signalling Co., Pittsburgh, Pa., and with the Westinghouse Electric Corp.

Mr. Young then went to Chicago as sales manager of the Central Electric Co., at that time one of the important electrical jobbers. It was in 1908 that Mr. Young and Mr. Pearl incorporated the Delta-Star Electric Co., both men leaving Central Electric Co. in 1909 for participation in Delta-Star affairs.

Mr. Young had been active in the old National Electric Light Association and its successor, the Edison Electric Institute, and in the National Electri-



Fiberglas Insulated Electric Motor



"HIGH-SAFETY-FACTOR" INSULATION CUTS DOWN MOTOR FAILURES

Do you want to reduce time and money losses caused by "burnouts" of motors, generators, transformers and other electrical equipment? Many engineers, production executives and maintenance men do it by insisting on Fiberglas "High-Safety-Factor" Insulation Materials for new equipment and maintenance work.

These insulating materials are made from fibers of glass that are unaffected by moisture, oil and corrosive acids or vapors. They possess high heat resistance and great tensile strength, providing a strong, thin, flexible base for insulating impregnants.

The cost of the extra protection afforded by Fiberglas Insulation is slight—only a fraction of the cost of the original equipment. Invaluable savings in time and machinery more than offset the cost of Fiberglas.

Fiberglas Electrical Insulation Materials are sold nationally by leading distributors and are available in the form of laminates, mica combinations, insulated wire, treated or untreated tying cords, braided sleevings and cloths.

Ask your Fiberglas Distributor for the complete story on the use economies of Fiberglas. Add the "extra" protection of "High-Safety-Factor" Insulation to your electrical equipment.

Here is performance and application data about Fiberglas that may help solve your insulation problem. Write today for the new Fiberglas Electrical Insulation Materials catalog, EL 46-11. Owens-Corning Fiberglas Corporation, Dept. 858, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

ASK FOR FIBERGLAS IN YOUR NEW MOTORS—AND ON YOUR NEXT REWINDS

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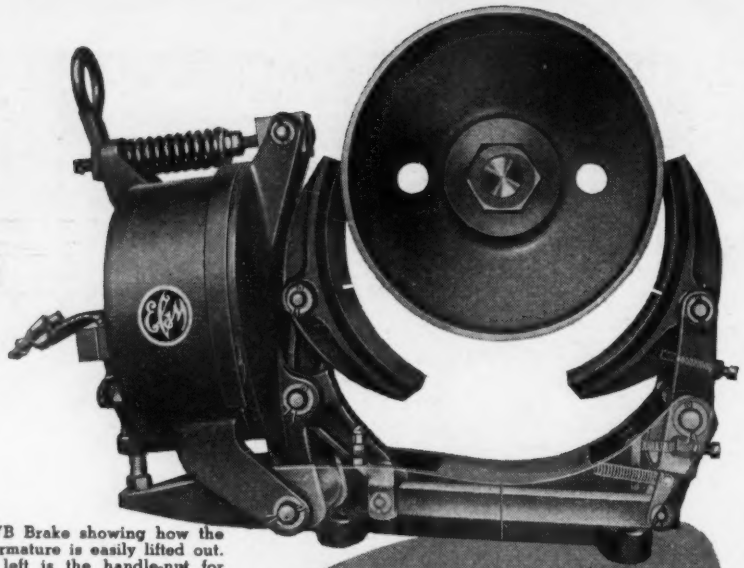
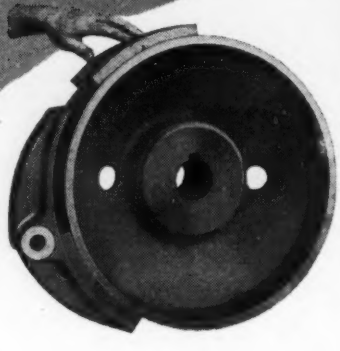
OTHER FIBERGLAS PRODUCTS: Thermal Insulations • "Dust-Stop" Air-Filters • Fiberglas Yarns and Cloths • Fiberglas Mats



Type WB Brake showing how the motor armature is easily lifted out. At top left is the handle-nut for compressing the spring when removing motor armature, changing brake shoes and for manual control.

Long Life Brakes for A-C and D-C Motors by EC&M

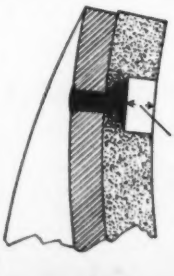


The brake lining is molded to match curvature of wheel and shoe.

These Type WB Brakes for a.c. and d.c. service have a block type lining which is both thick and tough.

Furthermore, due to the process of manufacture, the blocks have proper frictional quality *throughout the entire thickness* permitting uniform and complete wear down to rivet heads. And since the material is non-compressionable, brake adjustments are infrequent.

EC&M Type WB Brakes are built in several sizes. They can be supplied with series or shunt-wound operating coils for direct current motors. On alternating current service, they are supplied in shunt-wound form for use with a compact rectifier-unit. Send for Bulletins 1004 and 1006 describing these long life brakes.



Actual wearing thickness, between rivet heads and brake wheel, is ⅛" on the smallest size to ½" on the largest size.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

cal Manufacturers Association. He was a fellow of the American Institute of Electrical Engineers. On several occasions Mr. Young read papers at the International High-Voltage Conference meeting in Paris.

•

Dr. Addams S. McAllister

Dr. Addams S. McAllister, former editor of ELECTRICAL WORLD and assistant director of the National Bureau

Underwood & Underwood

of Standards until his retirement last year, died at Clifton Forge, Va., on Novemember 26 at the age of 71. Dr. McAllister was particularly well known for his pioneer work in illuminating engineering and in the design of alternating-current motors.

Dr. McAllister was born at Covington, Va., was graduated from Pennsylvania State College and was awarded master's and Ph. D. degrees by Cornell University in 1901 and 1905. After connections with the Berwind-White Coal Mining Co. and the Westinghouse Electric Corp., he joined the teaching staff at Cornell. It was in 1905 that he became associate editor of ELECTRICAL WORLD and in 1912 its editor. In 1915 he resigned to take up engineering work as consulting engineer.

Going to the Bureau of Standards in 1921, five years later he became head of the Bureau's division of specifications and three years later was made assistant director in charge of the commercial standardization group. The Bureau's Year-books were prepared under his direction.

•

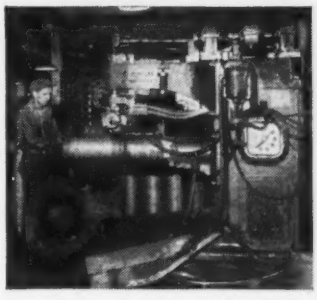
Peter O. Knight

Peter O. Knight, retired president of the Tampa (Fla.) Electric Co., died at his home in that city on November 26 at the age of 80. He relinquished the duties of president of the

Silicone News

DC SILICONES

DC Silicone Insulation Enables Transformers To Take Overloads



Photo, courtesy Everhot Heater Co.

Overloads and moisture caused frequent failure of the air cooled, 150 k.v.a. transformer in this welding machine used by Everhot Heater Company of Detroit. Welding 38 to 60 inch lengths of 10, 11, 12 and 13 gauge steel at a rate of 23 to 33 inches per minute in a machine having a throat of only 30 inches created more heat than conventional organic insulation could stand. Add to that the presence of moisture common to such welding operations, and you have service conditions far too severe for conventional insulation, but well within the range of DC Silicone Insulation.

The only alternatives to frequent failure under such difficult service conditions are new equipment designed for heavier duty or Silicone Insulation. Everhot Heater Company chose to have the coils of their welding machine rewound with Silicone Insulation by National Electric Welding Machine Co. That choice has resulted in a very considerable saving. Rewinding present equipment with DC Silicone Insulation gives it greater heat and moisture resistance than it had to begin with. That means more reliable operation and longer service and it saves capital investment. It's worth finding out about.

Instructions on how to apply DC 996, the Silicone insulating varnish for electric machinery are given in pamphlet No. L 3-3.

*Trade mark, Dow Corning Corporation.

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Chicago Office: Builders' Building
Cleveland Office: Terminal Tower
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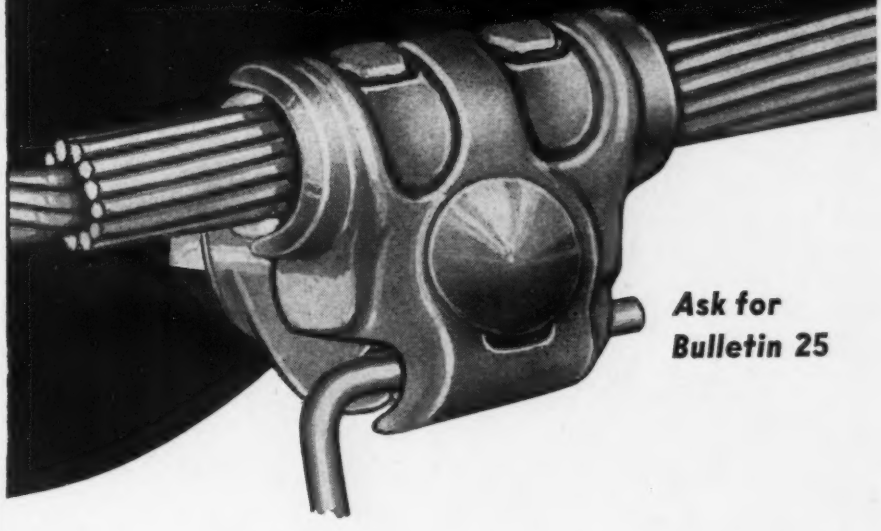
In Canada: Dow Corning Products Distributed by Fiberglas Canada, Ltd., Toronto

Dow Corning
FIRST IN SILICONES

SHERMAN Announces an IMPROVED CAST ALUMINUM ARMOR ROD CLAMP



Ask for Bulletin 25

Catalog No. R101
— For Copper Tap Connections

A pure copper liner is bonded by a special process in small groove.

LARGE GROOVE:
#6 to #1/0 ACSR over Armor Rods

SMALL GROOVE:
With Copper Liner
#8 to #1 stranded copper
#8 to #2A Copperweld
Standard Package quantity—100

Catalog No. R102
— For Aluminum, Amerductor or Galvanized Steel Strand Tap Connections

LARGE GROOVE:
#6 to #1/0 ACSR over Armor Rods

SMALL GROOVE:
#6 to #1 ACSR
#10SCG to #2SCG Amerductor
#9 Solid to 3/8" Galvanized Steel Strand
Standard Package quantity—100

UNIQUE INTERLOCKING CONSTRUCTION ELIMINATES NEED OF REMOVING BOLT TO INSTALL

Your linemen will like these improved new Sherman Armor Rod Clamps.

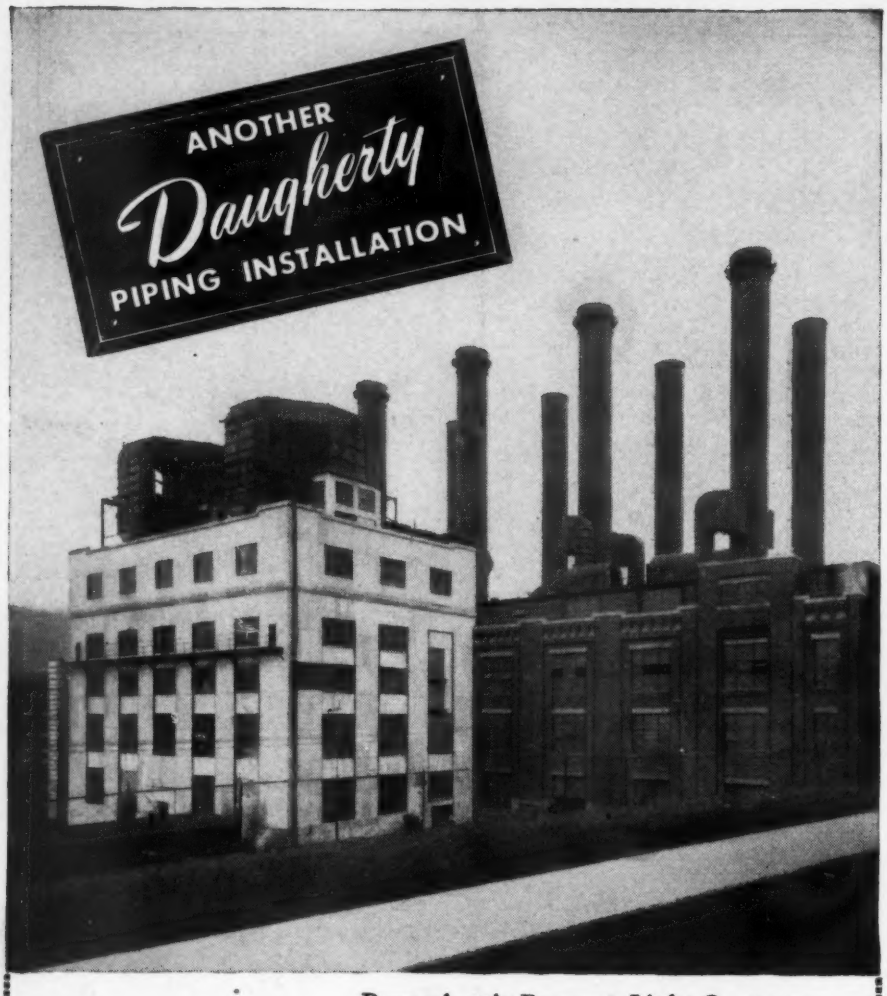
Clamp bodies are a special silicon aluminum alloy having exceptionally high tensile strength and corrosion resistance. Full size 3/8" galvanized steel carriage bolt with large nut and lock washer. Interlocking fingers enclose armor rods in full grip.

The construction of this clamp permits installation without removing nut or bolt.

Order from your wholesaler.

H. B. Sherman Mfg. Co.
BATTLE CREEK, MICHIGAN

Sherman
ELECTRICAL CONNECTORS



Pennsylvania Power & Light Company
Hauto Steam Electric Station

The new addition to the Hauto Station pictured here is another noteworthy installation made by the Daugherty Company – long experienced in the fabrication and erection of power and process piping. In this new addition, two boilers operate at 1325 p.s.i. and 930° F. to serve a turbo-generator of 31,250 KW capacity.

Daugherty Company offers these facilities for power and process piping work: FABRICATION of high-pressure, high-temperature piping including alloy tubing. EQUIPMENT for field stress-relieving and radiographic inspection. WELDERS qualified for all classes of work. SUPERVISION by an unexcelled metallurgical, engineering and construction staff.

Daugherty Company, Inc.

502 Union National Bank Building, Youngstown 3, Ohio

PIPING CONTRACTORS for the POWER and PROCESS INDUSTRIES

Tampa utility early this year after 53 years of continuous service with the company.

Mr. Knight was born in Freeburg, Va., and was graduated from Valparaiso University, Valparaiso, Ind. He moved to Fort Myers, Fla., where he began the practice of law and where he was elected mayor. He was later elected to the State Legislature and was State's Attorney of Hillsborough County. He then turned to private business.

In addition to being president of the Tampa utility, Mr. Knight was on the directorate or interested in a score of other companies.

•

G. Bertram Regar

G. Bertram Regar, who retired in 1942 as assistant to the vice-president of the Philadelphia Electric Co. in charge of sales, died on November 27 of a heart ailment at Boca Raton, Fla. He was 67 years old.

A past-president of the Illuminating Engineering Society, Mr. Regar devoted his entire career to the development and promotion of lighting. His first connection was with the Welsbach Co. He became affiliated in 1909 with the Philadelphia Electric Co. as an illuminating engineer and upon the formation of the lighting service division in 1916, he was made manager. In 1931 he became a departmental head on the staff of George E. Whitwell, vice-president in charge of sales, and later was appointed assistant to the vice-president in charge of sales.

Mr. Regar joined I.E.S. at the time of its organization in 1906, served on many of its committees, both locally and nationally, and was national president in 1936-1937. He served as chairman of the lighting sales bureau of the old National Electric Light Association. Mr. Regar was selected by the U. S. National Committee of the International Commission on Illumination to speak on lighting promotional work in America at the International Illumination Congress in Germany in 1935.

•

► FRANK M. TRAVIS, president of the Torrington (Conn.) Electric Light Co. and chairman of the board of the Torrington Water Co. and the Bridgeport Gas Light Co., died in Torrington on November 25 at the age of 79. Mr. Travis was also a director of the Connecticut Power Co. and of the Torrington utility. He formerly served as president of the New Britain Gas Light, Winsted Gas and the Litchfield Water companies. He was a native of Torrington and represented that city in the Connecticut General Assembly in 1900.

Where and How to Use *Crapo* Steel Conductor

Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

Crapo Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.

Indiana Steel & Wire Company
Muncie, Indiana

Crapo
Steel Conductors

WHAT do the customers think about strikes against electric utilities?

WHAT is the history behind the recent Pittsburgh power strike?

ELECTRICAL WORLD editors offer you the answers to these in 2 special editorial reprints:

- **Strikes Against Electric Utilities—**

A 16-page article on customer opinions concerning the right to strike, arbitration, fact-finding, treatment of workers, etc.

- **The Pittsburgh Story—**

An 8-page feature on the history of the Pittsburgh power strike, and its effect upon the city, people and economy. An account of how a small group of faithful employees of the Duquesne Light Co. kept machines running to supply electric service for 27 days.

Both of these timely reprints are yours at the following prices:

1	$0.50 pair
10	0.30 "
25	0.20 "

For larger quantities, write for quotation. Address order, accompanied by remittance, to:

EDITORIAL DEPARTMENT

ELECTRICAL WORLD

330 West 42nd St., New York 18, N. Y.

THIRTY YEARS OF PIONEERING IN ELECTRIC WATER HEATING

Pioneering a new industry is not an easy task. New trails must be broken, prejudices overcome and principles proved by the acid test of experience. The Clark stands first in electric water heating today because the principles it pioneered thirty years ago have stood up under toughest service in all kinds of waters.

That we are constantly striving to build into Clark even better performance and longer life is evidenced by the latest development to come out of the Clark research laboratories — Ionodic protection against corrosion. Tank life more nearly approaching that of the Clark element is assured, even in highly corrosive waters. The coming years will certify that in pioneering this improvement Clark has once again proved its leadership in electric water heating.

McGRAW ELECTRIC COMPANY
CLARK WATER HEATER DIVISION
5201 W. 65th STREET, CHICAGO 38

CLARK
ELECTRIC WATER HEATERS
A Toastmaster Product

MANUFACTURERS & MARKETS

Modern Light Sources and Techniques Utilized in Restyled Sylvania Center

Lighting especially designed to permit one group of people to enjoy a television show while others in the same room read or play cards, a kitchen with fluorescent lamps concealed in cabinets to give a high level of virtually shadowless illumination directly on work surfaces, and a combination bedroom-den decorated in light are incorporated in the newly restyled rooms of the Sylvania Lighting Center, which had its formal opening last week.

Created to display the latest techniques in providing efficient yet decorative lighting for modern homes and to serve as a proving ground for new lighting equipment manufactured by the company, the redecorated rooms utilize black light, germicidal light and infrared heat lamps as well as new adaptations of both tubular and circular fluorescent lighting combined with the latest incandescent floor and table lamps.

The basic idea throughout the five rooms—a combination television-living room, bedroom-den, kitchen, bathroom, and study — according to Don P. Caverly, director of the Sylvania Lighting Center, is to make light itself an integral part of the decorations.

"In the Lighting Center," said Mr. Caverly, "we have attempted to determine, through actual use, the most practical methods of applying all the new forms of lighting now available for the home, with particular emphasis on fluorescent lamps and fixtures."

Throughout the Center, the fundamental unit is a simple lighting strip with a self-contained ballast, and this type strip has been hidden above a fish tank, in bookcases, in kitchen cabinets, in direct and indirect coves and in valances. Illumination without an apparent source is, according to the engineers, architects and stylists who designed the rooms, a new concept in lighting and is good form for moderate visual tasks.

The general lighting scheme incorporates built-in fluorescent elements and incandescent floor lamps, blended to create sufficient light and a homey atmosphere. In the living room black light is used during television reception periods. The U-shaped kitchen utilizes the basic principles of successful industrial lighting. Both local and general illumination are obtained from 4,500-deg. white fluorescent tubes giving a shadowless, 40-foot-candle maintained average result.

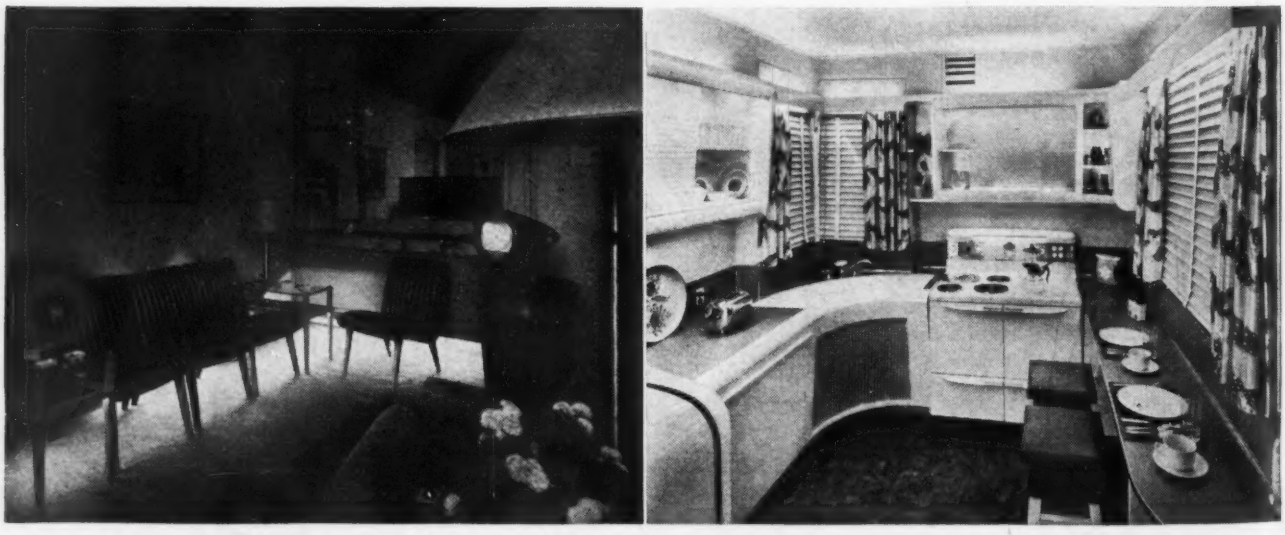
Bedroom and bathroom are also treated to comforting light. In the bedroom, fluorescent is used to provide general as well as local lighting. To facilitate nail and hair drying an infrared heat lamp is incorporated in the dressing table.

Two columns of tinted, fluted glass, extending from the counter to the ceiling, each containing a 64-in. slim fluorescent tube, furnish the general illumination for the bathroom. The tube length virtually eliminates shadows from any portion of the face.

•

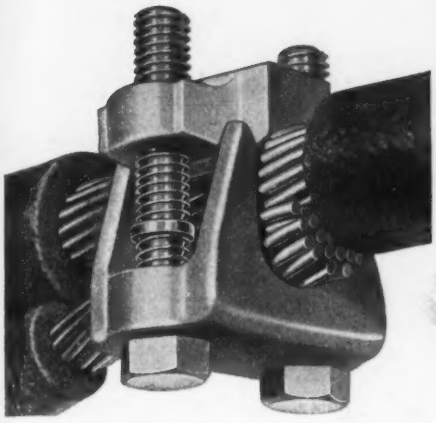
Organizes Sales Agency

Announcement has been made of the formation of a sales agency, C. P. Yoder, 130 West Chippewa St., Buffalo 2, N. Y., to sell various types of electric heating equipment, utility line materials and other apparatus to industries in New York state and western Pennsylvania. Mr. Yoder has a broad background of experience as an electric heating specialist and analyst of industrial operations. Until recently he was associated with the Buffalo Niagara

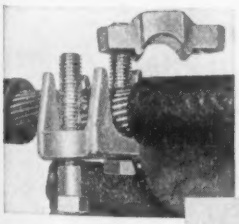


MODERN HOME LIGHTING—In the living room when normal lighting is turned off so that a television program can be seen under darkened conditions, black light units concealed beneath the shelves, tables and chairs make the specially treated carpet glow. In the kitchen, strips of concealed 4,500-deg. fluorescent lamps, which follow the perimeter of the room, provide 40 foot-candles on the working surfaces

MATTHEWS UNICLAMP CONNECTORS

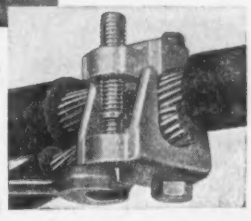


Made for use on copper or aluminum wires from 2/0 to 1000 MCM inclusive. They will connect two wires of their rated size or one wire of their rated size with one or more smaller tap-off wires down to No. 8 solid. They have many advantages over the larger sizes of connectors of the split bolt and other designs as they provide greater pressure between wires, hence greater holding power, are less costly, are easier to install and the assembled design is such that parts cannot become separated.



Fit on conductor as shown. Position top member and partially thread in free bolt.

Insert top wire and equally draw up both bolts.



Write for Bulletin 206

W. N. MATTHEWS CORP.
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ST. LOUIS 8, MO.

Men with ideas get AHEAD!

Men get IDEAS at the Air Conditioning Exposition!

IT'S coming—the 7th International Heating and Ventilating Exposition—largest ever held and first in seven years. Here is your opportunity to familiarize yourself with the newest ideas, products, and people in the industry. It will give you the chance to "catch up" on new trends, to discuss your problems with engineering specialists at the exhibition booths, to revitalize your thinking.

The more fully informed you are on the newest and best equipment available, the more successfully you can plan efficient, economical installations. On display at the Exposition will be all types of heating, ventilating, air conditioning, and related equipment—some excitingly new, all interesting . . . all a part of the up-to-date picture *you* need.

A wealth of helpful information awaits architects, industrial engineers, consulting engineers, manufacturers, contractors, distributors, building owners and operators—*anyone* concerned with the efficient application of heat, ventilation, and conditioned air to all types of buildings—industrial, commercial, residential.

Mark the date on your calendar. It's an event you can't afford to miss!

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7th INTERNATIONAL HEATING & VENTILATING EXPOSITION
The Air Conditioning Exposition
LAKESIDE HALL, CLEVELAND, OHIO • JANUARY 27-31, 1947
Under the auspices of the American Society of Heating & Ventilating Engineers

Management of International Exposition Co., Grand Central Palace, N. Y. 17, N. Y.

HERE IT IS—
SYLVANIA'S THIRD FLUORESCENT LIGHTING CONTEST

$2000.00

IN CASH PRIZES

FOR THE BEST SCHOOLROOM LIGHTING FIXTURE DESIGN *and Lighting Layout...*

★ ★ ★

FIRST PRIZE . . $500.00 **THIRD PRIZE . . $200.00**

SECOND PRIZE . $300.00 **FOURTH PRIZE . $100.00**

and 18 ADDITIONAL $50.00 PRIZES

In case of ties duplicate prizes will be awarded. Closing date: March 15, 1947. Entry blanks must be postmarked before midnight January 1, 1947.

Here's your opportunity to contribute to the encouragement of better lighting throughout the American school system—and win a valuable prize as well! Send in, today, coupon below to receive free, complete information—plus entry blank—about Sylvania's third big, new contest.

Stuart Goodwillie, Sylvania Electric Products Inc., 500 Fifth Ave., New York 18, N. Y. Kindly send details of Third Sylvania Lighting Contest.

NAME.....

ADDRESS.....

CITY.....**STATE**.....

SYLVANIA ELECTRIC

MAKERS OF FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

Electric Corp., Buffalo. Among the companies which Mr. Yoder will represent are the C. M. Hall Lamp Co., Detroit; W. N. Matthews Corp., St. Louis; Steel and Alloy Tank Co., Newark, N. J., and Triangle Equipment Co., Inc., Huntley, N. J.

•

General Electric Pricing Policy Outlined by Wilson

Emphasizing that the General Electric Co. is not making a general "across the board" price increase, Charles E. Wilson, president of the company, stated that each of the company's 200,000 products has been or is being studied separately "in an attempt to restore something like the normal balance between costs and selling prices." Mr. Wilson declared that each price increase "has been made reluctantly and has been as small as we could make it."

Maintaining that the company "has done more than its share to keep down the cost of living," he pointed to the report by the U. S. Bureau of Labor Statistics that all prices which go to make up the cost of living have risen 45.7 percent between 1940 and September of this year, whereas G.E. prices increased approximately 18 percent. "At the same time," the General Electric president said, "the average hourly earnings of General Electric employees increased 55.1 percent."

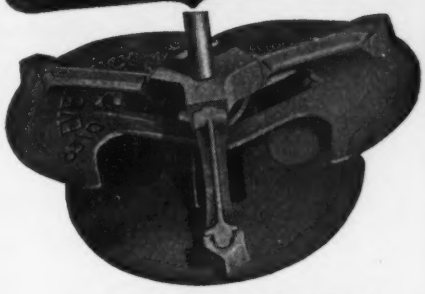
After the lifting of government price controls on November 10, the company began to correct prices "that had gotten out of adjustment during the long period of government control," he said. Some of the company's products had been selling at a loss, he stated.

"With the removal of price control, many of the component parts and materials which we purchase from others have been increasing in price," he explained.

In the home appliance field, Mr. Wilson said, the total price increase has averaged less than 10 percent and retail prices of several products on which the company has reached substantial volume have been raised less than 2 percent.

Citing specific examples, Mr. Wilson said that the prices of irons have been raised less than 1 percent, that some prices have not been raised at all, as in the case of automatic blankets and automatic toasters. Refrigerator prices have been increased 12½ percent; electric ranges, 11 percent, and washers, 30 percent. Even though it was found necessary to increase electric lamp prices about 6 percent last July 1, with OPA approval, lamp prices are still lower than they were in 1940.

EVERSTICK ANCHORS...



FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

HI-BOY SIGN

for Street and Highway Use

Will not blow over, leaving your men and the public unprotected.

Sign frame pivoted on each side allowing movement with varying wind pressures and full vision at all times.

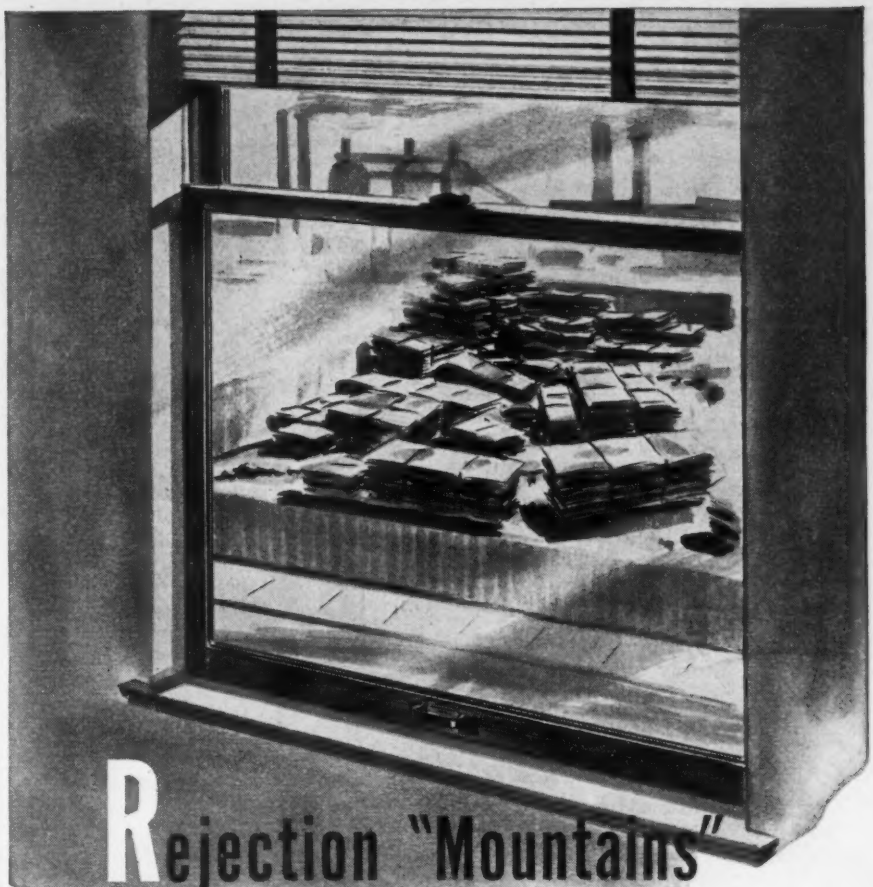
Attractively and rigidly constructed folds compactly for storing.

IPCO

COMPLETE INFORMATION ON NEW BULLETIN EW-126

Safety Equipment for all Industries

INDUSTRIAL PRODUCTS COMPANY
2808 N. FOURTH STREET • PHILADELPHIA 33, PA.



Rejection "Mountains" make bad Scenery!

Of course in your particular industry they may only be "mole hills" but whatever their size they represent loss in manpower, time, money and material.

To meet the ever-growing need for exact materials-inspection the HYPERSONIC ANALYZER* was developed to "see through solids with sound".

- For non-destructive testing of solid materials
- Detects flaws and faulty laminations in metals, plastics, and bonded assemblies
- Highly accurate—locates internal flaws and voids
- Wide frequency range permits inspection of more types of materials
- Reduces production costs by detection of faulty material *early* in processing

Brush engineers will be glad to talk over your particular problems. For complete information about this new non-destructive testing investigate the Hypersonic Analyzer.

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a product of

THE BRUSH DEVELOPMENT CO.
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BLACKBURN Service Entrance CONNECTORS are the strongest on the market—yet they are small and compact. Made of DURONZE—the alloy that is 75% stronger than hard copper or commercial bronze—they will not stretch or distort, nor come loose. They're the most durable connectors on the market today. *It pays to use a QUALITY product*—and cut maintenance costs. Get BLACKBURN Connectors from your Jobber today!

BLACKBURN *Service Entrance* CONNECTORS

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CONVENIENTLY-LOCATED
JOBBERS' STOCKS

BUILDERS OF QUALITY CONNECTORS FOR OVER 10 YEARS

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FIRST, MADISON & CLINTON STS. • ST. LOUIS 6, MISSOURI

NEW! WIDE RANGE
Insulation Resistance Meter
50,000 MEGOHMS
VIBROTEST
Model 261

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NOT
JUST AN
INDICATOR

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CENTER
SCALE
1200
MEGOHMS

Self-contained • Compact • Easily Portable

- Highest accuracy. Hand-stepped scale.
- Calibrates at infinity.
- Voltage regulator in measuring circuit.
- For extreme temperature variations. Tested from 40° F. below zero 140° F., above.
- NO TIRESOME CRANKING. Has its own dependable power source.
- Condenser charging circuit for faster condenser testing.
- Size: 8⅞" x 6" x 8¼." Weight 17½ lbs. Weatherproof carrying case.

Ask for Bulletin 210

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221C SOUTH GREEN ST. CHICAGO 7, ILL.

Engineeering Service Representatives in all principal cities.

Recent Rate Changes

BRYAN, OHIO, municipal light plant has raised electric rates to consumers 10 percent, effective December 15. The Board of Public Affairs put the rate into effect by lowering the discount rate for prompt payment of bills from 20 percent to 10 percent. The discount rate for some time had been 25 percent and was changed to 20 percent last year. The increase was made necessary by rising costs of fuel, labor and materials.

CONNECTICUT LIGHT & POWER CO. will put into effect electric rate changes, which will total $500,000 annually. New rates will go into effect on January 1. Rate reductions will apply to a number of commercial and small power customers and to some residential consumers.

ARIZONA EDISON CO. has announced that users of electricity in the Miami, Ariz., area will receive a substantial reduction in their rates on all billings on and after November 1. Reductions total about ¼ cent per kilowatt-hour. Savings represented by the reduction will amount to $9,155 annually for electrical customers.

LOCKHART (S. C.) POWER CO. has been authorized by the state Public Service Commission to revise residential electric rates, effecting substantial saving to customers. The company's present practice of furnishing both residential and commercial electric service under the same rate schedule will be changed so that commercial customers will continue to receive service at the present residential-commercial schedule, while residential customers will receive service under the approved new schedule.

BOONVILLE (IND.) MUNICIPAL LIGHT PLANT electric rates have been increased under the terms of an ordinance passed by the City Council. According to Mayor Stevens, the increase became necessary because of the rise in the price of coal and repairs. Operating costs have increased to such an extent that sufficient revenue has not been available to take care of the operating expense, bonds and interest charges. The new rate became effective November 25.

CONSOLIDATED EDISON CO. of New York, Inc., and Westchester Lighting Co., its subsidiary, have asked the New York Public Service Commission to postpone until June 30, 1947, certain proposed rate changes in New York. The rate changes were scheduled to go into effect December 7, this year. The company originally proposed to establish a uniform rate schedule in New York by eliminating certain non-uniform service classifications. These classifications were mostly local rates which arose out of the merger of Brooklyn Edison Co. and the New York & Queens Electric Light & Power Co., subsidiaries. It was the company's plan to withdraw these classifications and absorb them into their proposed four-classification rate schedule. The effect would be to increase certain bills by $1,100,000. The company stated it was asking for the delay in order to give its customers additional time to make necessary adjustments in their operations and to make necessary changes in their wiring and installations.

HANCOCK-WOOD ELECTRIC COOPERATIVE, serving seven northwestern Ohio counties, has announced a 7 percent reduction in electric rates, effective November 20.

Eliminate
ARCING and BURNING
with TRANSPARENT PLASTIC,
WIRE PROTECTORS

LABORATORY and FIELD TESTED

Transparent PLASTIC, WIRE PROTECTORS are tough and resist abrasion. They prevent fraying of insulation at friction points, eliminate arcing and burning, increase dielectric strength and reduce current leakage to a minimum.

- Lighter in weight. Inexpensive.
- Quicker and easier to install.
- Interlock. Made continuous by simple overlap.
- Stable and flexible at all temperatures.

Transparent PLASTIC, WIRE PROTECTORS are now serving Public Utility companies satisfactorily. Your inquiry invited for test samples and further information.

MARTIN M. STEKERT
45 West 34 St., Dept. P. New York 1, N. Y.

Both Up and Down!

Yes - - you can

Raise Efficiency
Pull Down Costs

and eliminate unnecessary employee fatigue with these light-weight, portable, economical

Coffing Hoists

DESIGNED FOR
EFFICIENCY - SAFETY - DURABILITY

Coffing Hoists are sold by leading distributors and supply houses in all principal cities.

CONTACT YOUR DEALER OR WRITE FOR FORM E4.

Coffing Hoist Co.
MANUFACTURER OF QUALITY PRODUCTS
DANVILLE, ILLINOIS

One Man Pulls Cables— Takes Up Slack

No. 324 Simplex Wire Tensioning Jack: 2-tons capacity, 20¼" take-up with every grip. Weighs only 13 lbs.

Exerts a powerful straight line pull, making it easy and safe for one man to pull overhead and underground cables, or take up the slack in guy, trolley and transport wires. Quickly hitched, using standard wire grips and slings. Lever has safety clip—cannot fall out. Write for Catalog No. 45.

Simplex
LEVER SCREW - HYDRAULIC
Jacks
Templeton, Kenly & Co.
Chicago (44), Illinois
Better, Safer Jacks Since 1899

V HIGH TENSION PORCELAIN **INSULATORS**

The Victor "V" imprint on high tension insulators certifies that the porcelain is made from best quality clays . . . workmanship is of highest standards . . . laboratory and electrical tests are exacting. Play safe. Always specify Victor.

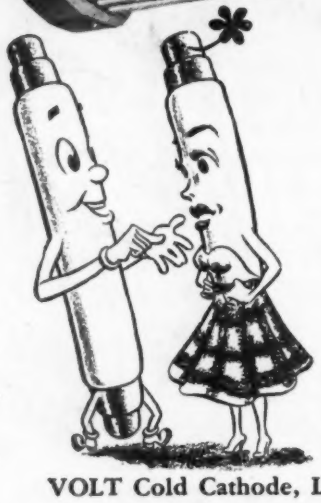
VICTOR INSULATORS, INC.
VICTOR, NEW YORK
BIRTHPLACE OF FIRST WET PROCESS HIGH-VOLTAGE INSULATORS

FOOT CANDLES TALK!

with

*COLOVOLT

Cold Cathode—Low Voltage Lighting



and here's what they say:

"Lower maintenance cost—longer maintenance of a given foot-candle level—greater dependability because of guarantee (One year of light guaranteed, except for failure due to breakage)—instantaneous starting—no flickering—continuous line lighting." These extra advantages are available to commercial and industrial users of light when installations are made with COLOVOLT Cold Cathode, Low Voltage Fluorescent Lamps and Fixtures.

Write for illustrated material and technical data.

*Trade Mark Registered U. S. Patent Office

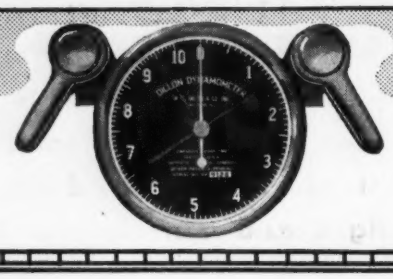
GENERAL LUMINESCENT CORPORATION
660 S. FEDERAL STREET CHICAGO 5, ILLINOIS

DEAD ACCURATE
EASY TO USE

Takes out guesswork of "sight and sag", or oscillation wire stringing. Hooked on in a jiffy. Indicates tension in seconds. Measures only 8¼" x 6¼" x 3". Capacities 500 to 20,000 lbs.

A Lot of Critical Testing to Do

MAKE SURE WITH THE
DILLON DYNAMOMETER



The Dillon is universally used in telephone work. Accuracy, and long-lived dependability are the answers. Indicates exact tension in guy strand, messenger and wire.

Many other uses where pull, torque, weight or overload are vital factors.

Write, wire or phone for illustrated Dynamometer Manual.

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LETTER TO THE EDITOR

1950 Market— 1920 Sales Methods

To the Editor of ELECTRICAL WORLD:

Since reading the article on "Best Ways to Sell Best Lighting," it has been my plan to write you a letter. First of all, I am very much in agreement with your going to the sales field for the information published. As you well know, the gigantic strides which were made in the development of illuminating engineering between 1910 and 1918 were the results of studies that were made as a means of supplying the sales organizations with answers to customer's problems. We need much more of that type of work.

Secondly, you have certainly gone to considerable effort to secure an index to the attitudes and plans being sponsored by the power companies in their post-war activities. This assembly of information should be of material value to the trade.

While it is my pleasure to compliment you upon this achievement, it is a job that is done, and what should concern us now is the job coming up, the next (1947) lighting number of ELECTRICAL WORLD. Consequently, the time now seems opportune to present suggestions along the line of one's personal interests so that you may have access to other possibilities when you begin work on the issue for next year.

In line with the above, may I first call attention to the fact that many of the directors of lighting service bureaus of power companies are not vitally interested in illumination? A rather sad state of affairs! Well, of the 103 replies which you received, how many asked for more data or tools? Each of these men could use more information on the relative merits of incandescent, fluorescent and neon lighting! Thus, the No. 1 problem making for better lighting sales for the power company would be that of getting a man better trained in the art in the position of director of the lighting sales activity. Perhaps there is need for some means of giving each of these men a rating based upon training, experience, aptitude, contributions to the art, special problems or accomplishments, etc.

The second point to be made is the need for better training for lighting specialists. Frankly, I do not believe that a man can learn a trade by watching a "motion picture show" for six hours! He may get an introduction to the study in that way, but the mastery of the subject requires drill and instruction. If the factor mentioned above was cor-

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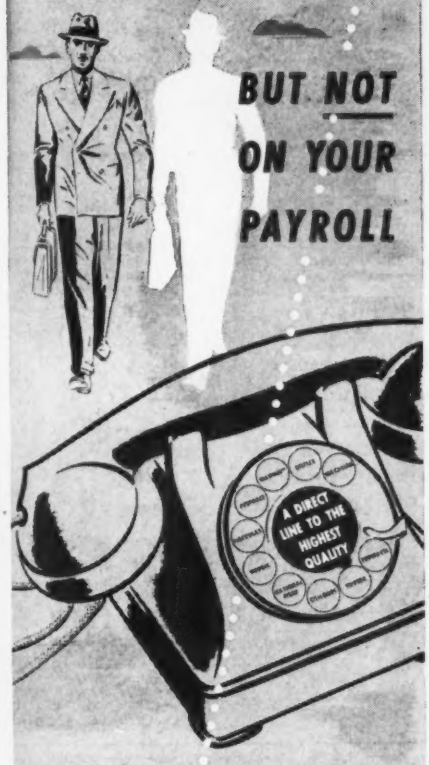

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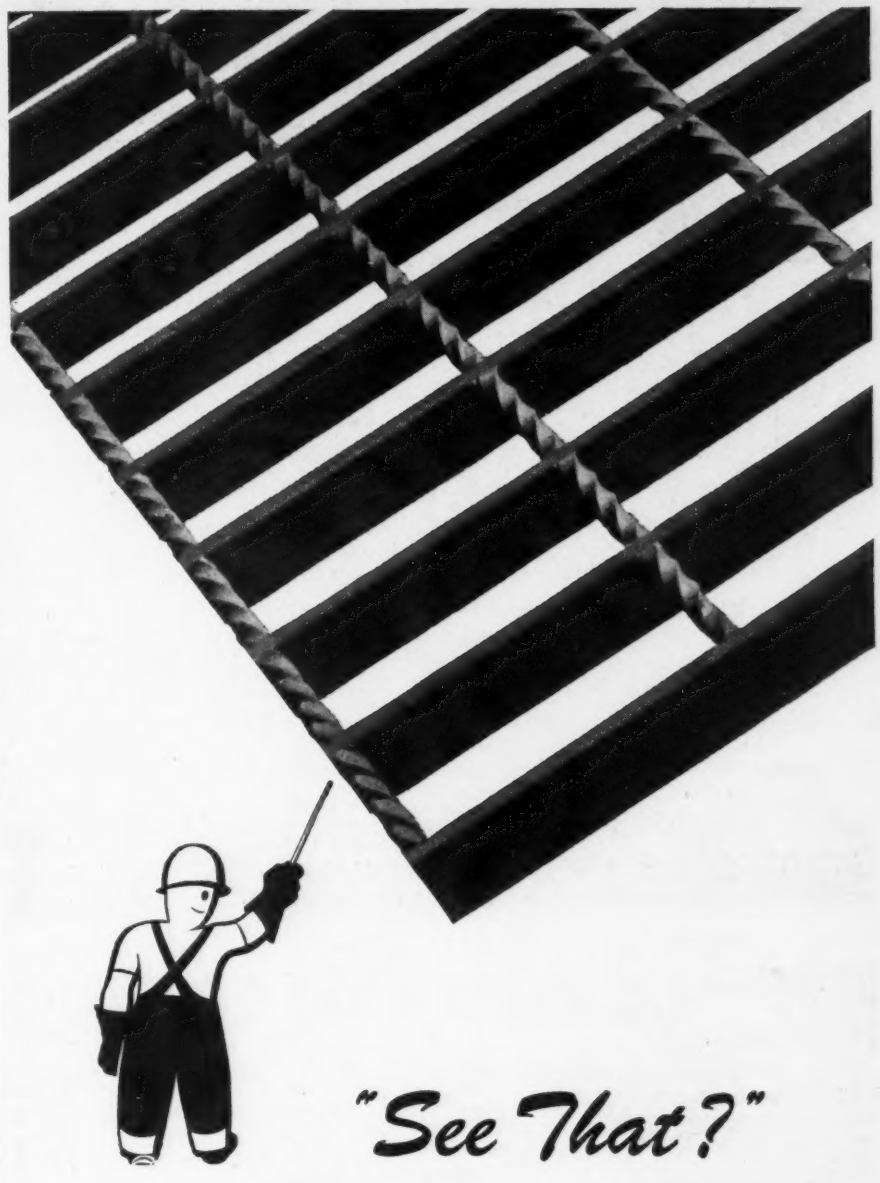

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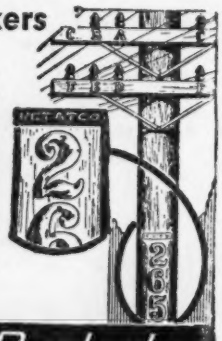

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rected (i.e., his work was supervised by a capable man), he could receive additional instruction as a supplement to his work.

The third point to be included is that light is a subjective element, and is not, therefore, to be understood by the materially minded person, regardless of how diligently he labors or how many sales orders he can produce. This situation makes it imperative that great care be exercised in the selection of personnel for a lighting service bureau.

What the Customer Likes

The fourth point for consideration is the matter of the customer's likes and dislikes for various types of lighting. This particular subject has been a hobby for me for nearly 20 years, since in my experiences in the lighting sales field it was found to be a very important factor. By way of introduction, you may be interested in a short analysis which appeared in ELECTRICAL WORLD (January 30, 1932) under the caption, "Match the Psychology of Lighting with Activity of User." Application of this method in the field showed that "Light for the Job" was not the answer; but, instead the matter of providing satisfactory lighting was a personal or individual problem. *Electrical West* (December, 1941) presented the results of further study in an article which they entitled, "Lighting Experts vs. Buyer's Desires." It had to do with harmonized lighting. As this study implies, I find that there is a very definite correlation between the type of lighting an individual will like and the manner in which his thought processes function. While I have enjoyed a broad contact with lighting men, it has been found that very few of them recognize a need for a sense of aptness in providing illumination for various types of customers. Seemingly, they are not concerned with the fact that a customer may have a "creditable" lighting system installed and yet make very little use of it because the effect is not to his liking. The continued payment of high revenues for lighting service and the acceptance of higher intensities of illumination depend upon the effect being satisfactory and pleasing to the user. Furthermore, improved customer relationships are a must for many utilities. Lamp companies depend upon long hours of daily usage for increases in their lamp replacement business. And, a new basis for making changes in lighting equipment will certainly not be detrimental for lighting fixture manufacturers and their dealers.

The fifth item to be included in this list would be the use of light for attaining some given, definite aim or objective, as attraction, impression, etc. Light is much more than "the essential

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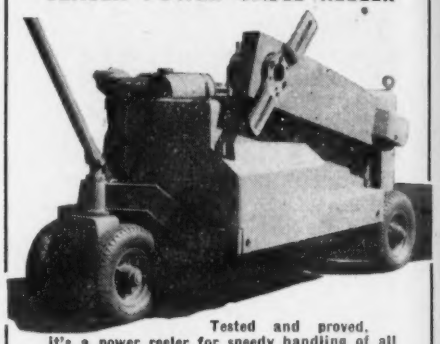

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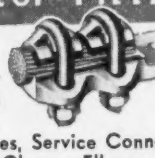

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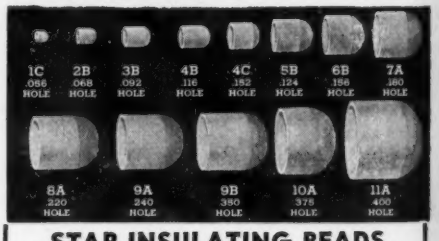

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